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Introduction

The production of the more important minerals and metals is summarized in the table on this page. The details appear in subsequent pages. It will be found that in some cases our contributors give figures that do not agree with our own. The explanation of such differences will generally be that the articles of outside contributors were necessarily written and put into type before our own statistics were available. The necessity of handling the great mass of material in this huge number in a few days leaves no time for leisurely comparison and revision to effect a careful coördination of all the data. We feel sure that no one, in the light of this explanation, will be misled by any discrepancies that may be discovered.

PRODUCTION OF METALS IN THE UNITED STATES

Metal	Unit	1912	1913	1914
Aluminum.....	pounds	(g) 32,990,000	(g) 49,601,500	(h) 45,000,000
Copper (a).....	pounds	1,241,762,508	1,225,735,834	1,135,730,818
Ferromanganese.	long tons	227,725	229,834	172,514
Gold (b).....	dollars	93,451,500	88,884,400	92,823,500
Iron.....	long tons	29,499,422	30,736,477	23,083,580
Lead (c).....	short tons	410,006	433,476	533,373
Nickel (e).....	pounds	42,168,769	47,124,330	(e) 30,067,064
Quicksilver.....	flasks	(f) 25,147	(h) 20,000	16,300
Silver (b).....	troy ounces	63,766,800	66,801,500	67,929,700
Zinc (d).....	short tons	348,638	358,262	360,689

(a) Production from ore originating in the United States. (b) The statistics for 1912 and 1913 are the final and those for 1914 are the preliminary statistics reported jointly by the directors of the Mint and the U. S. Geological Survey. (c) Production of refined lead from ore and scrap originating in the United States: antimonial lead is included. (d) Total production of smelters, except those treating dross and junk exclusively; includes spelter derived from imported ore. (e) Imports; for 1914, first 10 months only. This nickel is refined in the United States for the production of metal, oxide and salts. (f) As reported by U. S. Geological Survey. (g) As reported by the Metallgesellschaft, Frankfurt am Main. (h) Estimated.

PRODUCTION OF MINERAL AND CHEMICAL SUBSTANCES

Substance	Unit	1912	1913	1914
Arsenic.....	pounds	5,852,000	4,624,140	8,651,940
Coal, anth. (a).....	short tons	84,478,527	91,626,825	91,552,187
Coal, bitu. (a).....	short tons	449,964,723	478,688,867	419,547,599
Coke (a).....	short tons	42,528,653	45,953,808	34,418,933
Copper sulphate.....	pounds	39,480,741	54,330,000	31,776,670
Iron ore.....	long tons	59,196,778	61,847,116	42,911,897

(a) The coal and coke statistics are the estimates of Coal Age.

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To all the contributors, who collaborated in this number we tender our thanks, and also to the many persons who have assisted in the collection of statistical information. Our thanks are due also to the producers of copper, lead, spelter and other substances, who have communicated to us the amount of their output in 1914 and have thereby enabled a close approximation to the actual production in 1914 to be made by Jan. 6, 1915, our date of going to press.

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We commend to our readers a careful reading of the remarkable series of reviews of technical progress that appears in this issue. Mr. Knopf writes of advances in the science of economic geology, Mr. Megraw of stamp milling and cyanidation, Professor Hofman of the metallurgy of lead, Mr. Addicks of the metallurgy of copper, Mr. Ingalls of the metallurgy of zinc, and Mr. Cranston of gold dredging. All of these contributors are of national reputation as experts in their specialties; several of them are of international reputation. Such contributions as they offer in this issue are real enrichments of technical literature and are especially valuable to the general practitioner as expert summaries of what has been done in technical metallurgy.

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Last year we were able to give at this time figures of the world's production of copper, gold, spelter and tin in the year that had closed a few days previously. These figures were not mere guesses, but were based on official reports covering 10 or 11 months of the year, with estimates only for November and December. When the final figures were published several months later, they were found to vary from our preliminary figures by only a trifling percentage. The statistics that we are able to present this year are far more incomplete than last year, and even the collection of those that we are able to publish has been attended by unusual difficulty, reflecting the disturbances created by the war.

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Thus, no information could be obtained from Germany, no producer in that country being willing to communicate information that might be useful to the enemy. Reports that were due to us from Russia, France and Australia were lost or delayed in the mails and it proved impossible to supply missing figures by cable, which sort of communication proved also to be more or less uncertain. On the other hand, some of our communications from London and Japan came along with ordinary dispatch.

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In the collection of the domestic statistics there were also some unexplainable difficulties. The upset conditions in copper production presented a good many opportunities for the duplication of figures, and an unusual amount of telegraphing was necessary to settle doubtful questions. Similar difficulties were experienced by the Director of the Mint in collecting the statistics of gold and silver production, according to communications received from him. His statistics, which are usually published on Jan. 1, were belated several days.

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American mining companies that publicly announce their dividends paid $55,563,732 in 1914, compared with $73,440,701 in 1913. Canadian and Mexican companies paid $15,058,220 in 1914, and $21,654,260 in 1913.

United States metallurgical and holding companies connected with the mining industry, paid $91,782,505 in 1914, as compared with $99,740,693 in 1913.

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The unsold stock of spelter in the hands of American smelters at the end of 1914 was 23,500 tons, a huge decrease from the record stock of 64,000 tons at the mid-year.

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The world's 1914 production of gold was $455,305,385, as against $462,699,658 in 1913.

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The world's production of copper was about 913,000 metric tons in 1914, compared with 1,006,000 in 1913.

Metal Markets

NEW YORK—Jan. 6

Copper and spelter have both turned strong. Lead shows a weaker tone. Tin has been about stationary.

Copper, Tin, Lead and Zinc

Copper—The business of the last week was light, but toward the close a distinctly firmer tone developed, partly because of the advance in London and partly because of increased inquiry from domestic consumers, especially the brass makers. While no considerable business has yet developed, those interests which had previously been offering copper cheaply withdrew their offers, and the prices asked were raised to figures approaching 13¼c., regular terms, while some of the principal producers were confident that they would soon be able to sell at their former price of 13½c. regular terms. This was in fact realized in the afternoon of Jan. 6, when some considerable sales were reported at that price, while copper had been available in the morning at 13c. New York.

Business is said to be good with the brass makers, fair with the sheet rollers, but still rather poor with the wire drawers.

The Anaconda company having exhausted its stock of wirebars at Great Falls, Mont., has resumed work in its refinery at that place in order to supply wire drawers in the Middle West. The Great Falls plant will be operated at the rate of 5,000,000 lb. per month for two months, obtaining the crude copper from Anaconda. This does not mean any increase of production by the Anaconda company, but simply a partial diversion from Raritan to Great Falls in order better to fill orders.

The Bureau of Commerce reports the exports of copper from the United States for the week ended Dec. 26 at 2,839,000 lb., of which 1,569,000 lb. were destined to Sweden and 1,151,000 lb. to Great Britain. Imports of copper included 826,000 lb. metal and 1,596,000 lb. in ore and matte.

Visible stocks of copper on Jan. 1 are reported as follows: Great Britain, 19,950 long tons; afloat for British ports 4825; total 24,775 tons. Stocks held in Rotterdam are estimated at 1150 tons.

Tin—In anticipation of poor statistics, the market here developed considerable weakness and business nearly subsided. Even the advance in London, which was mainly based on the spot position, could not arouse domestic buyers from their lethargy. The close is steady.

Visible stocks of tin on Dec. 31 are reported as follows: Great Britain, 7885; United States, excluding Pacific ports, 5511; total, 13,396 long tons, being 1913 tons more than on Nov. 30, and 497 tons less than on Dec. 31, 1913. Stocks include tin afloat.

Lead—Only a small business is reported, the price remaining unchanged at 3.80c., New York, but St. Louis has been a shade weaker.

Spelter—A rather large business is reported, chiefly with domestic consumers, who reappeared in the market after a long absence, sales being fairly large, including several 500-ton lots. The effect of this demand was to produce a sharp advance in the price. From day to day there was a wide diversity in prices asked, certain interests advancing their prices while others remained free sellers lower down. The activity continued right up to the close. Some export business was also reported.

Other Metals

Aluminum shows some inquiry but no large sales beyond the usual contract business. Quotations remain 19@19½c. per lb. for No. 1 ingots, New York.—**Antimony** is slow as to domestic business, but with some sales for export. The English embargo on exports from that country is affecting the market here. Ordinary brands are 13½@14c. per lb.; while 16@17c. is asked for Cookson's.—**Quicksilver** is dull and unchanged, with quotations $50 per flask of 75 lb., New York. London lower, at £11 per flask.—**Nickel**—Ordinary forms—shot, blocks or plaquettes—are 40@45c. per lb., according to size and terms of order. Electrolytic metal is 5c. per lb. higher.

Gold, Silver and Platinum

Gold—The week's engagements include $2,000,000 withdrawn from the New York subtreasury for export. It is believed that this will go to Canada on account of the City of Montreal loan lately negotiated in New York. This loan will also take $5,000,000 gold transferred to New York account at Ottawa, on French government bills.

Sales of gold bars at the Assay Office in New York in December amounted to $1,755,858, making the total for the year $60,616,438, against $34,283,992 in the year 1913, and $31,037,051 in 1912. The larger monthly sales in 1914 were $7,342,042 in October, $8,957,563 in January and $10,797,997 in February.

Silver has been quiet to steady so far this year. No special feature or tendency has developed, and for the present at least the market is quiet with moderate transactions.

Platinum—The market is quiet and demand light. Quotations are variable, $41@43 per oz. being asked for refined platinum and $46@49 for hard metal.

Exports and Imports of Metals, other than iron and steel, in the United States, 10 months ended Oct. 31, as reported by the Department of Commerce:

	Exports		Imports	
Metals:	1913	1914	1913	1914
Copper, long tons	356,821	334,815	153,171	118,876
Tin, long tons	1,054	592	40,647	39,976
Lead, short tons	42,522	60,561	50,216	20,909
Zinc, short tons	7,772	36,395	5,987	846
Zinc in ore, short tons	5,244	140	11,034	8,729
Nickel, lb	24,575,052	24,589,972	38,614,745	30,067,264
Antimony, lb	63,620	1,310,238	13,196,424	12,800,090
Aluminum, lb	44,435	18,939	20,775,102	14,398,031
Quicksilver, lb	74,947	28,230	.....	.....
Platinum, oz	1,191	143	101,717	66,544

Copper, lead, nickel and antimony include metallic contents of ore, matte, etc. Exports include reëxports of foreign material.

DAILY PRICES OF METALS IN NEW YORK

Dec. Jan.	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc	
			Electrolytic, Cts. per Lb.	Cts. per Lb.	New York, Cts. per Lb.	St. Louis Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.
31	4.8500	48⅞	12.65 @12.75	33⅛	3.80	3.60 @3.62½	@5.60	5.40 @5.45
1	.....	...	.....	...	....	.....	.....	.....
2	4.8500	48½	12.65 @12.75	32½	3.80	@3.60	5.60 @5.65	5.42½ 5.47½
4	4.8488	48¾	12.65 @12.75	33¼	3.80	@3.60	5.65 @5.70	5.47½ @5.52½
5	4.8488	48¾	12.80 @12.90	33½	3.80	@3.60	5.72½ @5.77½	5.55 @5.60
6	4.8450	48¾	13.00 @13.30	33½	3.80	@3 60	5.77½ @5.82½	5.60 @5.65

The quotations herein are our appraisal of the markets for copper, lead spelter and tin based on wholesale contracts; and represent, to the best of our judgment, the prevailing values of the metals specified as indicated by sales by producer, and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The difference between the price delivered and the New York cash equivalent is at present 0.15 to 0.20c. on domestic business and 0.25 to 0.37½c. on European. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Western brands. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are; St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Dec.-Jan.	Silver	Copper				Tin		Lead		Zinc	
		Spot									
		£ per Ton	Cts. per Lb.	3 Mos.	Best Sel'td	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
31	22 11/16	56⅜	12.30	57	61¾	147½	142	19	4.13	27¾	6.03
1	22⅝	...	.....	...	....	....	....	..	....	..	...
2	22 9/16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4	22⅝	57⅛	12.41	57½	....	151	1/3	19	4.13	28⅛	6.10
5	22⅝	57⅞	12.57	58¼	62¼	152	145½	19⅛	4.16	28⅜	6.16
6	22 11/16	59¼	12.87	59½	....	151½	146	19	4.13	28¼	6.13

*No quotations.

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26¼c.; £20 = 4.35c.; £30 = 6 52c.; £60 = 13.05c Variations, £1 = 0.21¾c.

Gold and Silver

By Frederick Hobart

The gold production of the world in 1914 again showed a reduction, although the decrease as compared with 1913 was less than the difference between that year and 1913. The total, according to our preliminary figures in 1914, was $454,305,885, which is $7,364,173 less than the corrected total for 1913. The decrease from 1912 to 1914 was $20,027,883.

In the table herewith, the figures for 1912 and 1913 have been corrected by official and other reports. Those for 1914 are based upon returns for 11 months, with estimates for the final months of the year from nearly all the principal countries. The figures for the United States

GOLD PRODUCTION OF THE WORLD

	1912	1913	1914
Transvaal	$188,599,260	$181,889,012	$173,275,610
Rhodesia	13,166,230	13,935,681	17,748,275
West Africa	7,386,028	7,846,560	8,805,000
Madagascar, etc.	2,925,000	2,044,600	1,980,000
Total Africa	$212,076,518	$205,715,653	$201,808,885
United States	$93,451,500	$88,884,400	92,823,500
Mexico	22,500,000	20,500,000	17,500,000
Canada	12,559,288	16,216,131	16,550,000
Central America, etc.	3,632,500	3,030,400	3,500,000
Total North America	$132,143,288	$128,630,931	$130,373,500
Russia, inc. Siberia	$27,635,500	$29,500,000	$26,500,000
France	1,847,000	1,812,100	1,450,000
Other Europe	3,615,000	2,950,000	2,600,000
Total Europe	$33,097,500	$34,262,100	$30,550,000
British India	$12,115,162	$12,176,783	$12,258,000
British & Dutch E. Indies	4,925,000	4,739,100	4,690,000
Japan and Chosen	7,165,000	7,394,300	7,500,000
China and others	3,750,000	3,658,900	3,625,000
Total Asia, not inc. Siberia	$27,955,162	$27,969,083	$28,073,000
South America	$12,425,000	$13,058,400	$13,250,000
Australasia	56,635,800	53,033,391	51,250,000
Total for the world	$474,333,268	$462,669,558	$455,305,385

are the preliminary estimate which has been furnished us by the Director of the Mint and the U. S. Geological Survey. Some revision of these will be made later, but this revision is generally an upward one, the early estimates being of a conservative nature.

Of the principal countries, the Transvaal, which is the largest producer of all, shows a decrease of $8,594,-

WORLD'S PRODUCTION OF SILVER

Smelters' Production—In Metric Tons

(From statistical report of the Metallgesellschaft, Frankfurt am Main)

	1911	1912	1913
Great Britain	536.1	499.3	395.1
Germany	420.0	476.0	537.9
Belgium	264.7	252.7	280.0
Spain and Portugal	134.9	117.6	a130.0
France	53.0	47.0	a47.0
Austria-Hungary	63.1	61.2	58.9
Italy	14.2	12.1	14.4
Norway	7.2	7.6	a 8.0
Russia	4.9	a 5.0	a 5.0
Turkey a	1.5	1.5	1.5
Sweden	.....	1.2	0.9
Total Europe	1499.6	1481.2	1478.7
United States	3891.9	4073.0	4059.1
Mexico	1055.6	b1063.2	b1159.2
Central and South America a	200.0	200.0	200.0
Canada	509.2	593.4	546.5
Total America	5656.7	5929.6	5974.8
Asia (Japan)	141.6	138.1	148.9
Australia	129.1	136.4	143.0
Total production	7427.0	7685.3	7745.4

a Estimated. b Fiscal years 1910-1911 and 1911-1912.

000, which is about the same as the difference between 1912 and 1913. Most of this decrease, however, was in the early months of the year and the second half of 1914 shows a considerable gain over the corresponding period of 1913. Rhodesia and West Africa, on the other hand, show large increases. In North America, the United States, rather unexpectedly, shows a substantial increase, the total coming alomost up to that for 1912.

GOLD PRODUCTION IN THE UNITED STATES

(Values)

State	1912	1913	1914
Alabama	$16,400	$9,200	$12,200
Alaska	17,198,600	15,201,300	15,850,000
Arizona	3,785,400	4,101,400	4,507,800
California	20,008,000	20,241,300	21,447,800
Colorado	18,741,200	18,109,700	19,881,100
Georgia	10,900	13,300	11,400
Idaho	1,401,700	1,244,300	1,066,000
Maryland	1,200	700	.....
Montana	3,707,900	3,320,900	3,935,100
Nevada	13,575,700	11,977,400	11,003,800
New Mexico	754,600	892,000	1,207,600
North Carolina	156,000	115,200	118,900
Oregon	759,700	1,477,900	1,594,500
South Carolina	15,400	4,100	6,100
South Dakota	7,823,700	7,214,200	7,310,000
Tenness	11,500	7,700	5,900
Texas	2,200	200	10,300
Utah	4,312,600	3,570,300	3,180,200
Washington	682,600	657,500	607,400
Wyoming	24,300	17,500	2,200
Continental U.S.	$92,989,900	$88,176,100	$91,760,300
Philippines	461,600	707,200	1,060,100
Porto Rico	.....	1,100	3,100
Total	$93,451,500	$88,884,400	$92,823,500

SILVER PRODUCTION IN THE UNITED STATES

(In Fine Ounces)

State	1912	1913	1914
Alabama	200	100	100
Alaska	539,700	366,700	398,500
Arizona	3,445,500	3,912,000	4,306,600
California	1,384,800	1,421,500	1,744,500
Colorado	7,933,100	8,989,700	8,612,900
Georgia	200	100	100
Idaho	7,862,900	9,477,100	12,689,500
Illinois	1,800	2,300	1,800
Maryland	700	.....	.....
Michigan	543,500	333,700	404,500
Missouri	30,000	38,900	60,000
Montana	12,524,000	12,540,300	10,746,000
Nevada	13,851,400	15,657,400	14,814,200
New Mexico	1,460,800	1,666,900	1,682,100
North Carolina	2,300	1.700	1,300
Oklahoma	.....	800	.....
Oregon	54,000	172,200	126,700
South Carolina	.....	.....	100
South Dakota	205,800	172,600	180,500
Tennessee	112,000	109,000	95,400
Texas	379,800	429,800	601,000
Utah	13,076,700	11,282,300	11,397,500
Virginia	700	200	1,000
Washington	350,800	218,700	54,100
Wyoming	300	1,200	100
Continental U.S.	$63,761,000	66,796,200	67,918,500
Philippines	5,800	5,300	9,700
Porto Rico	.....	.....	1,500
Total	$63,766,800	66,801,500	67,929,700

The gold production in the United States in 1914, according to the preliminary figures of the Mint and U. S. G. S., reached a total of $92,823,500, being $3,939,100 more than in 1913 and $372,000 more than in 1912. Increases were shown in nearly all the larger producing states, notably in California, Colorado and Alaska. There were small decreases in Nevada and Utah, but nearly all the other producers of any importance either held their own or showed very small changes. California was again the leading producer, with Colorado second, Alaska third, Nevada fourth and South Dakota fifth. Silver production in the United States is given also according to the preliminary figures of the Director of the Mint and the U. S. Geological Survey. The total production was 67,929,700 fine oz., being 1,128,200 oz. more than in 1913.

The decrease in gold production was contemporaneous with an increased demand for gold. The usual movement of gold and silver was altogether upset in the latter

part of the year by the general disorganization of trade and exchange due to the war, and it is hardly possible at the present time to give an intelligent summary of the actual movements. It is sufficient to say that every nation has done its best to hang on to the gold supplies which it possessed and to increase them wherever possible.

GOLD PRODUCTION OF THE WORLD FOR 20 YEARS

1895	$198,995,741	1905	$378,411,054
1896	211,242,081	1906	405,551,022
1897	237,833,984	1907	411,294,458
1898	287,327,833	1908	443,434,527
1899	311,505,947	1909	459,927,482
1900	258,829,703	1910	454,213,649
1901	260,877,429	1911	459,377,300
1902	298,812,493	1912	474,333,268
1903	329,475,401	1913	462,669,658
1904	349,088,293	1914	454,305,385

Gold and silver movement in the United States, 11 months ended Nov. 30, as reported by the Division of Statistics of the Department of Commerce:

	Gold		Silver	
	1913	1914	1913	1914
Exports	$81,226,017	$222,485,232	$58,319,092	$46,291,181
Imports	58,631,475	53,278,678	33,057,451	23,219,995
Excess, exports	$22,594,542	$169,206,554	325,261,641	$23,071,186

The large excess of gold exports in 1914 was due to the payment in gold instead of merchandise of debts due in Europe; a notable instance being the payment in gold of New York City bonds held abroad. In consequence of the war risks and difficulties in shipping, it became necessary to employ some devious methods. Thus the Bank of England established credits at Ottawa in Canada, in South Africa and in Australia where deposits of gold could be made and credited to the depositor in London, thus avoiding the risk of actual transportation by sea and the added danger from hostile cruisers.

Silver

The governing factors in the world's consumption of silver are the use of it in the arts and the requirement for coinage purposes, but especially the absorption in India and China. This being the case, the primary silver market of the world is London, the price in New York being but a reflection of the price there, with a differential covering the cost of delivering the bullion from New York to London. The normal differential between the official prices at London and New York is about 1½c. per ounce, but the disturbance in August caused this to run up to 6c. per oz., and even higher.

At the beginning of 1914 the price for silver was about 26½d. in London. The surplus supply taken over by a London banking syndicate from the India Specie Bank, which became insolvent in 1913, was being gradually liquidated, this process being facilitated by the diminished supply of silver coming from Mexico, the curtailment being estimated at about 2,000,000 oz. per month. The Indian bazaars which had been accustomed so long to deal with the reckless and involved India Specie Bank, were slow to recognize the quite different caliber of the syndicate then engineering the liquidation of the plethora on the London market. This operation naturally weighed upon the market during the first quarter of the year.

In March it was estimated that the available stock of silver in London and in the East was about 8,000,000 oz. less than at the beginning of the year, and early in April it became known that the London syndicate had closed out its holdings. The silver market then naturally began to acquire a little more tone. By the early part of May, a price of 27 3/16d. in London was reached, the Mexican troubles of that time being a contributary bullish influence. About $2,000,000 worth of silver—chiefly from Cobalt—went down in the "Empress of Ireland." In June the silver market turned dull and declining upon reduced demand from India and China, and at the mid-year the price was 25⅞d. In the latter part of July selling by Chinese banks caused a rapid decline to about 24d.

On Aug. 1 official quotations for silver, both in London and New York, were suspended. On Aug. 8 the official price at London was reëstablished at 26d., but this was for spot transactions only. An official quotation of 26d. warranted a New York quotation of 52c. only, the cost of freight and war insurance added to the usual charges then amounting to 6¼c. per oz. New York brokers were not, however, able to sell in London at all, owing to delay in the transmission of cables and the difficulties of transactions in foreign exchange.

MONTHLY AVERAGE PRICE OF SILVER

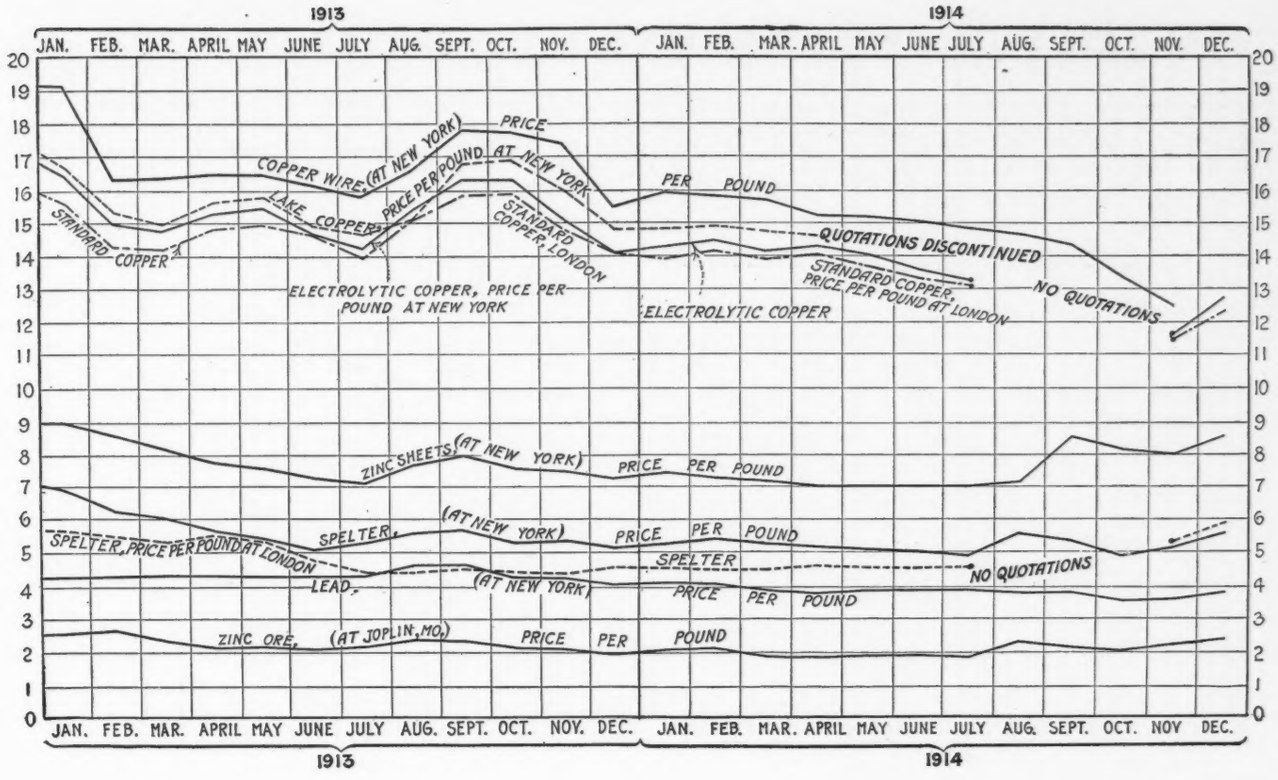
Month	New York			London		
	1912	1913	1914	1912	1913	1914
January	56.260	62.938	57.572	25.887	28.983	26.553
February	59.043	61.642	57.506	27.190	28.357	26.573
March	58.375	57.870	58.067	26.875	26.669	26.788
April	59.207	59.490	58.519	27.284	27.416	26.958
May	60.880	60.361	58.175	28.038	27.825	26.704
June	61.290	58.990	56.471	28.215	27.199	25.948
July	60.654	58.721	54.678	27.919	27.074	25.219
August	61.606	59.293	54.344	28.375	27.335	25.979
September	63.078	60.640	53.290	29.088	27.986	24.260
October	63.471	60.793	50.654	29.299	28.083	23.199
November	62.792	58.995	49.082	29.012	27.263	22.703
December	63.365	57.760	49.375	29.320	26.720	22.900
Year	60.835	59.791	54.811	28.842	27.576	25.313

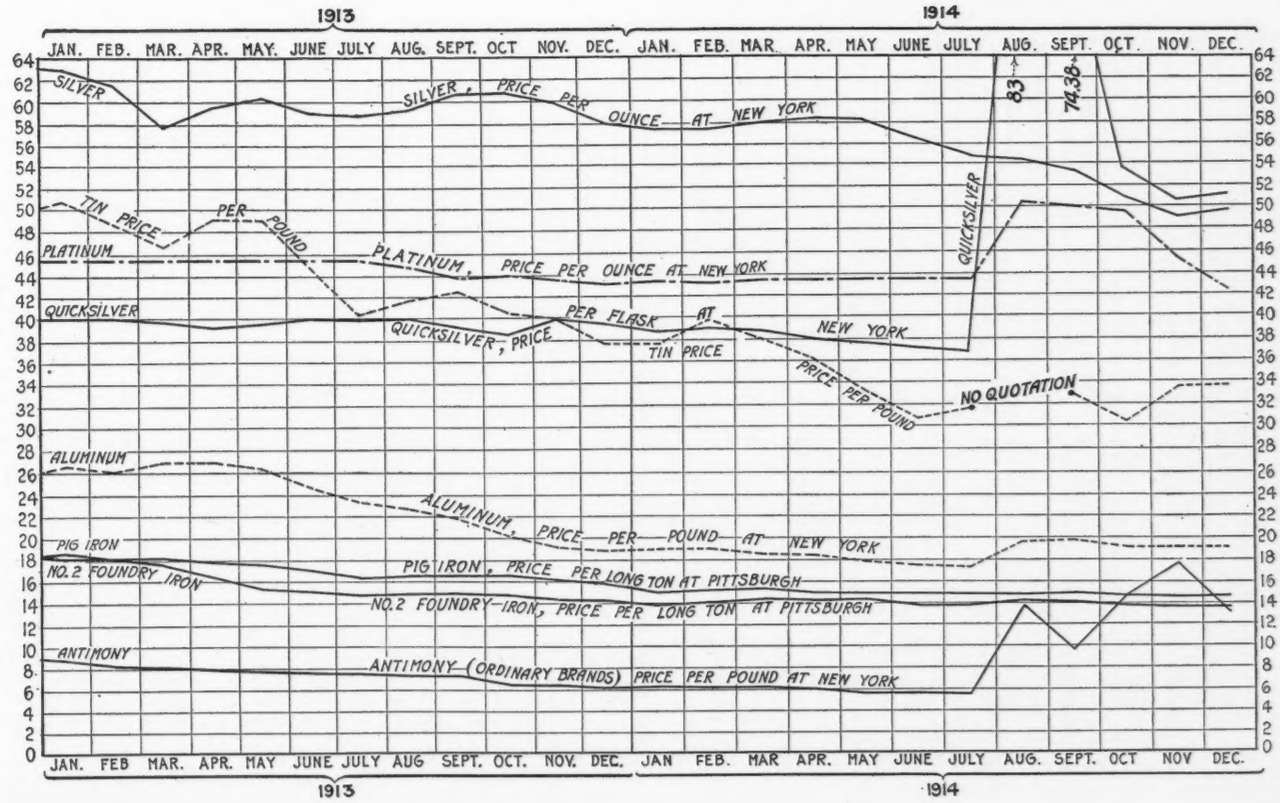
New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

The suspension of silver quotations produced a critical condition among silver miners, although the facts of the situation were promptly and fully recognized. Pressure was immediately exerted upon Washington to induce the U. S. Mint to buy silver. The Mint authorities consequently entered into negotiations with the smelters, as a result of which the Mint on Aug. 11 agreed to take 1,175,000 oz. at 52c. per oz., on condition that the smelters would agree to liquidate all silver that they owed to the miners up to the end of that day.

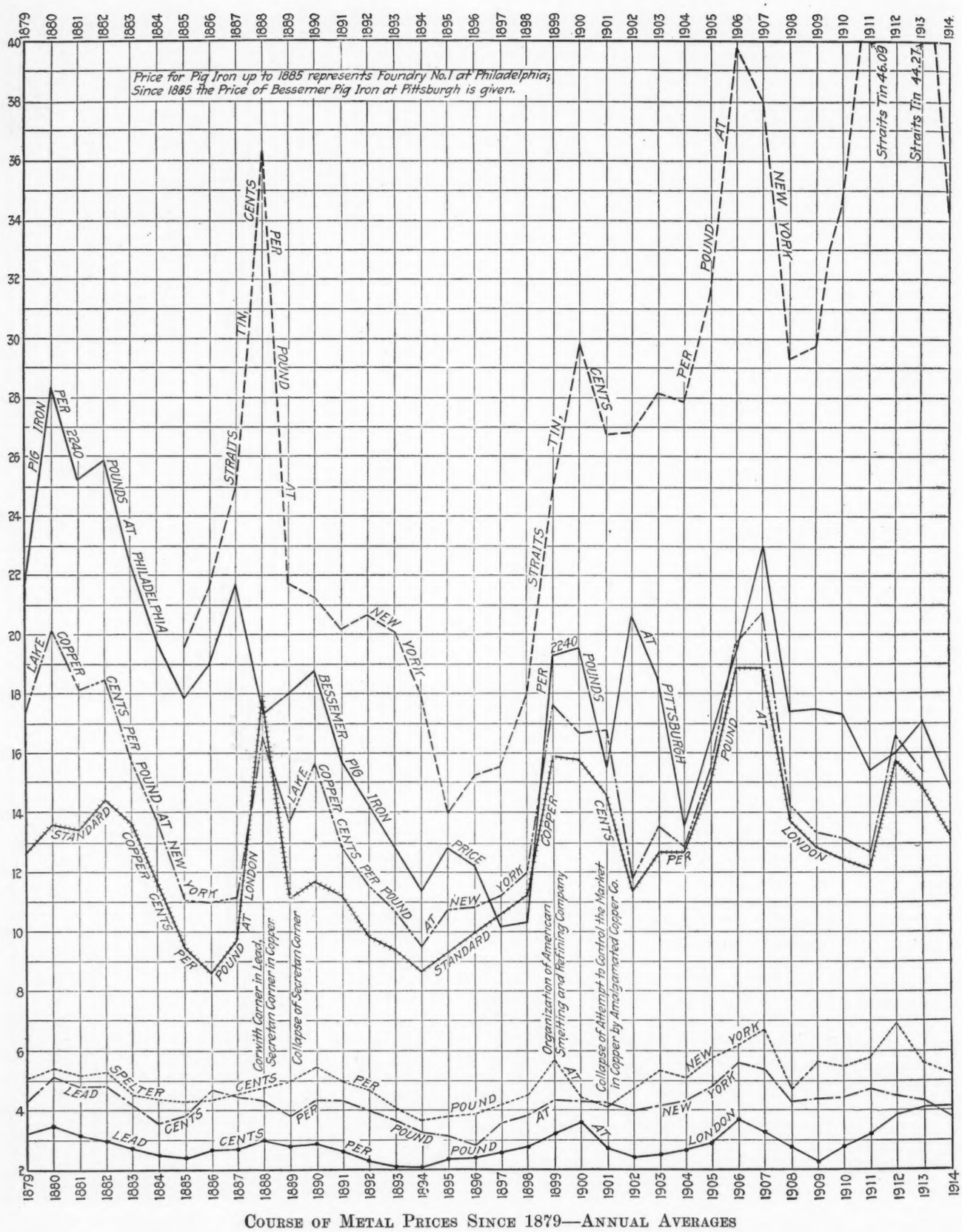
With the improvement in the situation as regards shipments and foreign exchange, producers began to send large consignments to London, especially in ships of the American Line, selling it for what they could get after it had been delivered there. The only buyer was the English Mint. The demand from the Far East was temporarily nil and continued to be insignificant for several months following. Not only was there great risk in shipping silver to the East, where the German cruiser "Emden" was at large on the Indian Ocean, but both India and China were unable to trade their exports for bullion, as a result of war conditions.

The conditions prevailing in the silver market after the outbreak of the war keenly affected those districts like Cobalt and Tonopah, which are essentially silver producers. Some of the mining companies of those districts which refine and sell their own product accumulated considerable unsold stocks. At the time when quotations were suspended some producers found fault, but in general everybody realized the nature of the emergency and coöperated for the common welfare. For a time silver was unsalable. To any producers who thought the contrary, the refiners were willing to hand back their product and let them sell it themselves if they could. A few tried to do this and made rather a mess of things.


1913
1914
JAN. FEB. MAR. APRIL MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
COPPER WIRE (AT NEW YORK) PRICE PER POUND AT NEW YORK
LAKE COPPER
STANDARD COPPER
STANDARD COPPER, LONDON
ELECTROLYTIC COPPER, PRICE PER POUND AT NEW YORK
PRICE PER POUND
QUOTATIONS DISCONTINUED
STANDARD COPPER, PRICE PER POUND AT LONDON
ELECTROLYTIC COPPER
NO QUOTATIONS
ZINC SHEETS (AT NEW YORK) PRICE PER POUND
SPELTER, PRICE PER POUND AT LONDON
SPELTER, (AT NEW YORK) PRICE PER POUND
LEAD, (AT NEW YORK) PRICE PER POUND
ZINC ORE, (AT JOPLIN, MO.) PRICE PER POUND


1913
1914
JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
SILVER, PRICE PER OUNCE AT NEW YORK
83
74.38
QUICKSILVER
TIN PRICE PER POUND
PLATINUM, PRICE PER OUNCE AT NEW YORK
QUICKSILVER, PRICE PER FLASK AT NEW YORK
TIN PRICE
PRICE PER POUND
NO QUOTATION
ALUMINUM, PRICE PER POUND AT NEW YORK
PIG IRON, PRICE PER LONG TON AT PITTSBURGH
NO. 2 FOUNDRY-IRON, PRICE PER LONG TON AT PITTSBURGH
ANTIMONY (ORDINARY BRANDS) PRICE PER POUND AT NEW YORK

METAL PRICES IN 1913 AND 1914, MONTHLY AVERAGES


Price for Pig Iron up to 1885 represents Foundry No.1 at Philadelphia;
Since 1885 the Price of Bessemer Pig Iron at Pittsburgh is given.
PIG IRON PER 2240 POUNDS AT PHILADELPHIA
LAKE COPPER CENTS PER POUND AT NEW YORK
STANDARD COPPER CENTS PER POUND AT LONDON
STRAITS TIN CENTS PER POUND AT NEW YORK
BESSEMER PIG IRON PRICE AT PITTSBURGH
LAKE COPPER CENTS PER POUND AT NEW YORK
STANDARD COPPER CENTS PER POUND AT LONDON
STRAITS TIN CENTS PER POUND AT NEW YORK
Straits Tin 46.09
Straits Tin 44.27
LEAD CENTS PER POUND AT NEW YORK
SPELTER CENTS PER POUND AT NEW YORK
LEAD CENTS PER POUND AT LONDON
Cornwith Corner in Lead.
Secretan Corner in Copper.
Collapse of Secretan Corner
Organization of American Smelting and Refining Company
Collapse of Attempt to Control the Market in Copper by Amalgamated Copper Co.

COURSE OF METAL PRICES SINCE 1879—ANNUAL AVERAGES

Copper

Both the world's and the American copper production exhibit large decreases from 1913, as was expected; indeed, the decreases are hardly so large as was expected. It is to be remarked, however, that the curtailment of about 50% by many important producers did not become fully effective until two-thirds of 1914 were gone; and, moreover, that it was based on their rate of production in July, 1914; not on their average rate of production in 1913.

During the first seven months of 1914 the production of copper was about stationary, or perhaps was a little more than the average rate of 1913. The outbreak of the war, interfering with consumption in all parts of the world, with the excision of Germany, a very large consumer, was an unforseen calamity. The producers met this condition as best they could. The Anaconda and the porphyry mines curtailed their production by about 50%. The Calumet & Hecla and Phelps, Dodge & Co. curtailed by 25%. As the price for copper fell toward 11c., many of the smaller producers suspended operations. Among these were Cananea, Shattuck Arizona, Mason Valley and British Columbia.

To a more or less extent a similar policy was adopted in foreign countries. Thus, Australia and Spain-Portugal curtailed production. Peru (Cerro de Pasco), Chile and Japan kept on at about the same rate as in 1913. Katanga increased its output, as did Cuba, where a new, rich mine had become productive. Russia had strong incentives to increase production, but the military troubles which caused the two producers of the Caucasus to suspend in November, reduced the total for the year, and even before that Russia had been obliged to import copper from the United States. The revolutionary troubles in Mexico had caused the output of that country to shrink even before the European war. Teziutlan was idle through the year and Aguascalientes and Torreon during most of it, operations not being resumed at those plants until late in the year.

The exports of copper from the United States in the first 10 months of 1914 were 733,302,369 lb., compared with 773,239,795 lb. in the corresponding period of 1913. Although this 10-month period of 1914 comprised only three months of the war, the exportation to Germany had decreased to 176,698,948 lb., compared with 259,217,551 in the corresponding period of 1913. The exports to Austria-Hungary, Belgium, France, Holland and Canada also showed decreases. On the other hand, there were increases in the exportations to Italy, Russia and Great Britain.

After the war began it became evident that Germany would buy a large quantity of copper if she could. However, it appeared that Great Britain made it a matter of military and political policy to keep copper out of Germany and her success in so doing was evidenced by copper becoming worth about 25c. per lb. in Germany. The seizure of many ships carrying copper from New York to Italy and Scandinavia provoked an international question, which was referred to in the American note of Dec. 24 to England in the following words:

> For example, a shipment of copper from this country to a specified consignee in Sweden was detained because, as was stated by Great Britain, Sweden had placed no embargo on copper. On the other hand Italy not only prohibited the export of copper but, as this Government is informed, put in force a decree that shipments to Italian consignees or "to order" which arrive in ports of Italy cannot be exported or trans-shipped. The only exception Italy makes is of copper which passes through that country in transit to another country. In spite of these decrees, however, the British foreign office has thus far declined to affirm that copper shipments consigned to Italy will not be molested on the high seas. Seizures are so numerous and delays so prolonged that exporters are afraid to send their copper to Italy, steamship lines decline to accept it and insurers refuse to issue policies upon it. In a word a legitimate trade is being greatly impaired through uncertainty as to the treatment which it may expect at the hands of the British authorities.

The total quantity of copper detained by Great Britain was about 45,000,000 lb. Holland, Sweden, Italy and Switzerland put embargoes on the export of copper, wherefore Germany could not openly procure copper through them. The action of Great Britain in detaining the copper consigned to those countries was apparently intended to make sure that it would not be smuggled through them in spite of their embargoes. Up to the present time this question has not been settled.

SMELTERS' PRODUCTION OF COPPER IN THE UNITED STATES

(In Pounds)

State	1911	1912	1913	1914
Alaska	19,412,000	32,602,000	24,452,000	22,860,000
Arizona	300,578,816	357,952,962	399,849,745	374,371,075
California	36,806,762	31,069,029	32,390,272	29,018,200
Colorado	8,474,848	7,502,000	7,670,090	8,840,000
Idaho	3,745,210	5,964,542	8,434,028	5,983,538
Michigan	216,412,867	231,628,486	159,437,262	157,089,795
Montana	271,963,769	309,247,735	285,336,153	232,590,737
Nevada	65,385,728	82,530,608	84,683,961	59,760,906
New Mexico	1,518,288	27,488,912	46,953,414	66,041,251
Utah	138,336,905	131,673,803	147,591,955	150,446,231
Washington	.....	1,121,109	448,805	141,023
East and South.	19,656,971	18,592,655	24,333,014	18,351,927
Other states	1,564,207	4,396,667	4,155,135	(a) 10,236,135
Totals	1,083,856,371	1,241,762,508	1,225,735,834	1,135,730,818

(a) Includes copper originating in states other than those enumerated and also copper whose origin could not be correctly distributed at this early date. Indeed, the distribution for 1914 in several cases in this table must be regarded as merely provisional. Thus, Utah is undoubtedly credited with more or less copper that belongs to Idaho and Nevada.

SMELTERS' PRODUCTION

(In Pounds)

Source	1911	1912	1913	1914
N. American ore	1,284,932,019	1,489,168,562	1,438,565,881	1,266,563,711
Foreign ore	34,392,091	53,701,307	55,803,202	52,277,948
Scrap	18,529,547	11,949,348	22,427,889	17,534,158
Totals	1,337,853,657	1,554,719,217	1,516,796,972	1,336,375,817
To foreign refiners	32,413,440	45,735,673	36,682,605	36,199,348
To American refiners	1,305,440,217	1,508,983,544	1,480,114,367	1,300,176,469
Crude copper imported	146,422,851	144,480,144	169,315,869	126,188,945
Total crude copper	1,451,863,068	1,653,463,688	1,649,430,236	1,426,365,414

WORLD'S PRODUCTION OF COPPER (a)

(In Metric Tons)

Country	1911	1912	1913	1914
United States	491,634	563,260	555,990	515,164
Mexico	61,884	73,617	58,323	35,436
Canada	25,570	34,213	34,880	33,248
Cuba	3,753	4,393	3,381	6,628
Australasia	(b) 42,510	(b) 47,772	(b) 47,325	(e) 33,782
Peru	28,500	26,483	25,487	22,876
Chile	33,088	39,204	39,434	38,270
Bolivia	2,950	4,681	(b) 3,658	(h) 3,500
Japan	(d) 52,303	(d) 62,486	(b) 73,152	(d) 68,058
Russia	(c) 25,747	(c) 33,550	(c) 34,316	(h) 32,000
Germany	(b) 22,363	(b) 24,303	(b) 25,308	(h) 28,000
Africa	(b) 17,252	(b) 16,632	(b) 22,870	25,700
Spain and Portugal	(b) 52,878	(b) 59,873	(b) 54,696	(i) 47,500
Other countries	(b) 26,423	(b) 29,555	(b) 27,158	(h) 23,000
Totals	886,855	1,020,022	1,005,978	913,162

(a) The statistics in this table are our own compilations, except where specially noted to the contrary. (b) As reported by Henry R. Merton & Co. (c) As officially reported. (d) Privately communicated to us from Japan. (e) Exports as reported by Henry R. Merton & Co. (h) Estimated. (i) Communicated through London.

The Copper Producers' Association suspended the publication of its monthly statistics upon the outbreak of the war, and the probability is that there will be no further publication of them. At the beginning of 1914 the stock of refined copper in the United States was 91,438,867 lb.; at the mid-year it was 106,110,663 lb. All talk about the stocks of copper at the end of 1914 is guesswork. As between June 30 and Aug. 31 there was undoubtedly an increase. As between Aug. 31 and Dec. 31 there is reason to believe there may have been a decrease. Even so, no encouraging deductions are to be drawn therefrom, inasmuch as whatever decrease, if any, there may have been is likely to have been more than offset by increase in the stock of blister copper.

In the early part of 1914 the copper industry was encouraged by the hope of an increase in consumption and the certainty that there was to be no great increase in production in the near future. The hope of increased consumption was disappointed. As to the coming new production, things remain as they were. Inspiration will probably begin during the spring of 1915 and Chuquicamata during the summer. The only big mine now being developed in the United States is the New Cornelia. The Katanga mines of Africa are slowly making an enlarged output and will probably become faster when their new smelting plant is finished. An important addition to copper supply will be made when the present producers consummate their plans to increase their percentage of copper extraction, but the increase in this way will be spread over a series of years.

COPPER PRODUCTION OF CHILE AND PERU, 1913 AND 1914

(In Pounds)

	Chile—1913	Chile—1914	Peru—1913	Peru—1914
Blister copper to U. S.	18,315,000	15,824,060	42,667,436	43,533,967
Copper in ore to U. S.	24,911,465	31,301,049	10,089,592	4,935,324
Copper to England and France	43,460,480	37,024,960	3,180,800	1,742,720
Sundries, estimated	250,000	220,000	250,000	220,000
Totals, lb.	86,936,945	84,370,069	56,187,828	50,432,011
Totals, metric tons	39,434	38,270	25,487	22,876

The Copper Market in 1914*

January—The market opened at 14.55c., a recession from the closing price of 1913, the important buying movement of the latter part of December having exhausted itself. Competitive selling led to a steady decline to 13.85c., which was registered at the middle of the month. Europe then became interested and bought so freely that the price advanced to 14.55c. at the end of the month. Domestic manufacturers also became interested in the market and it was believed that their orders reflected an increase in the ultimate consumption of copper.

February—The activity continued and on Feb. 11 the price stood at 14.65c., the highest point of the year. It appeared soon afterward that the important buying had been satisfied whereupon the market became dull and recesssional. At the end of the month the price was 14.25c.

March opened with more interest on the part of domestic manufacturers, who reported that business among themselves was not so bad as it had been pictured, and intimated that copper looked cheap and they might be tempted by bargains. The producers tried to meet them in this and copper was sold freely on a declining scale. Toward the middle of the month the pressure to sell from all quarters became emphatic, and the price dipped a trifle under 14c. A rather large business then developed, both for domestic and foreign account, the latter predominating, and by Mar. 17 producers had sold so liberally that one after another raised his price, with buyers following the market upward. At the close of the month the price stood at 14.30 cents.

April—By Apr. 4 the market stood at 14.55c., where the advance halted. A reaction in the London price at about this time permitted arbitrage business to be done at a profit. Europe continued to buy right along, and reports from abroad were that consumption over there continued at an excellent rate, the heavy shipments from this side going directly into consumers' yards, which was quite contrary to some of the absurd rumors which were finding currency here. With a check in demand and the uncertainties produced by the trouble arising between the United States and Mexico, the market declined to a trifle under 14c. on Apr. 23. On Apr. 27, however, there was a distinctly better feeling because of the improvement in the Mexican situation and Europe became a substantial buyer, which rallied the market, the month closing with copper at 14.15 cents.

MONTHLY AVERAGE PRICE OF COPPER

	New York Electrolytic				London Standard			
Month	1911	1912	1913	1914	1911	1912	1913	1914
Jan.	12.295	14.094	16.488	14.223	55.600	62.760	71.741	64.304
Feb.	12.256	14.084	14.971	14.491	54.974	62.893	65.519	65.259
Mar.	12.139	14.698	14.713	14.131	54.708	65.884	65.329	64.276
Apr.	12.019	15.741	15.291	14.211	54.034	70.294	68.111	64.747
May	11.989	16.031	15.436	13.996	54.313	72.352	68.807	63.182
June	12.385	17.234	14.672	13.603	56.365	78.259	67.140	61.336
July	12.463	17.190	14.190	13.223	56.673	76.636	64.166	60.540
Aug.	12.405	17.498	15.400	*	56.266	78.670	69.200	*
Sept.	12.201	17.508	16.328	*	55.253	78.762	73.125	*
Oct.	12.189	17.314	16.337	*	55.170	76.389	73.383	*
Nov.	12.616	17.326	15.182	11.739	57.253	76.890	68.275	53.227
Dec.	13.552	17.376	14.224	12.801	62.068	75.516	65.223	56.841
Year	12.376	16.341	15.269	.....	55.973	72.942	68.335	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper. *No quotations.

AVERAGE MONTHLY PRICES OF COPPER MANUFACTURES

(In Cents per Pound)

	1912		1913		1914	
	Copper Wire	Sheet Copper	Copper Wire	Sheet Copper	Copper Wire	Sheet Copper
January	15.75	19.50	19.09	23.50	15.94	20.75
February	15.25	19.50	16.38	22.50	15.88	20.50
March	16.03	20.30	16.39	21.50	15.60	20.35
April	17.06	21.50	16.50	21.50	15.25	20.25
May	17.30	21.63	16.50	21.50	15.23	19.90
June	18.68	22.50	16.18	21.10	15.03	19.56
July	19.13	22.50	15.88	20.50	14.88	19.38
August	19.13	22.75	16.60	21.50	14.63	18.80
September	19.13	23.50	17.84	22.50	14.34	18.00
October	19.13	23.50	17.75	22.50	13.34	17.38
November	19.13	23.50	17.28	21.15	12.50	17.50
December	19.13	23.50	15.79	20.50	14.25	18.88
Year	17.96	22.02	16.85	21.69	14.74	19.24

May—The market became extraordinarily dull and the price fell to 13.90@14c., remaining there until about the middle of the month when a moderately large business developed which put the price up to about 14.10c.; but again it fell away and the month closed with the market at 13.95@14 cents.

June—At the beginning the price was 13.85c. At the close it was 13.25c., the decline having been steady during the month.

July—Some hopeful tendencies apparent during the last few days of June began to materialize and July opened with the price at 13.30@13.35c. Around this figure consumers became interested and during the first

*On any given day copper is apt to be sold at a range of price even when the market is stationary, such range exhibiting the competition among sellers and the shopping among buyers; also there are differences in price according to conditions of sale. In periods of activity there are, moreover, changes in price between the beginning and end of a day. In quoting figures in this annual review we have reference to what we have in our weekly market reports during the year computed as the daily average price.

week of the month a big buying movement developed. It was estimated that the business of this week amounted to nearly 100,000,000 lb., the bulk being done with European buyers, who purchased for shipment over the next three months. With the stimulus of this large buying the price naturally advanced, but the upward movement was not quite so impressive as was heralded on the tickers. This buying movement advanced the price to 13.60c., but the publication of the June statistics, showing an increase of about 22,000,000 lb. in stock, cast a chill over things and producers became anxious to sell for whatever they could get, and soon after the middle of the month the market became distinctly weak. During the last 10 days of the month the disturbances in Europe produced an immediate effect. The outbreak of the war between Austria and Servia, bringing with it a financial crisis and a general desire on the part of the European merchants to reduce their commitments to a minimum, practically stopped all buying over there. It also increased the pressure to sell here. In the last two days of the month there was turmoil, but some domestic consumers were sufficiently courageous to contract for some round lots. The last reported sale on July 31 was at 12½ cents.

August—During this month there was practical paralysis, production was curtailed at the mines and to a less extent at the refineries; but although the output that was in transit and process of refining, which could not be checked, was daily swelling the accumulation of stock, the producers exhibited a unanimity in refraining from trying to sell their copper. Manufacturers were, of course, supplied with what they needed, but they naturally confined themselves to hand-to-mouth purchases. The JOURNAL suspended its regular quotations of the market on Aug. 1. Toward the end of August there was a little encouragement in the resumption of exports to England, but what went thither was chiefly the filling of old contracts or the shipment of copper on consignment.

September—During this month the situation remained unchanged, no effort being made to reëstablish a competitive market of buyers and sellers. Europe took copper more freely on the old contracts, but the demand from domestic manufacturers appeared to be reduced by a real diminution in the rate of consumption. Producers began to exhibit a little more nervousness. While during August they had been unwilling to let consumers have copper at less than 12¼c., by the end of September they were willing to supply it at as low as 11.60c. The exportation of a surprisingly large quantity of copper during September contributed toward the relief of the situation, but the British seizure of copper at Rotterdam and the closing of that inlet into Germany, which happened about the end of September, increased pessimism and led to considerable talk about the necessity for a further curtailment of production.

October—During the second week of this month there was some hopefulness about the development of a good domestic demand, but this petered out and everything again was shrouded with doubt and pessimism. There was a growing tendency among producers, however, to feel more free in their efforts to make sales and the market tended to become less one-sided than it had been. About Oct. 22 there developed some substantial buying by domestic consumers and it looked as if the market had regained approximately normal conditions upon the basis of the curtailed production. The level of price was then about 11c. After a few days of activity, however, the interest waned and there was uncertainty and confusion again when on Oct. 28 came the news of the detention by the British of five ships carrying copper to Italy and Scandinavia.

November—Within a few days, however, it was apparent that the market was going to take the further hampering of export business without flinching, and this was regarded as a very satisfactory test. The JOURNAL resumed quotations on Nov. 2 at 11.05@11.15c. Up to Nov. 7 the market remained at that level. Then began very excellent buying, chiefly by domestic manufacturers whose business had been slowly increasing. Once more they were willing to enter into contracts for forward deliveries and to resume business with the producers in the old way. There was no relaxation of interest during the remainder of the month, which closed with copper at 12½c., which was just where it closed in July.

December—The buying movement carried the price up to about 13.2c., but it came to an end about the middle of this month, and the market then relapsed to about 12.70c., New York.

Butte

BY B. B. THAYER*

Mining operations in Butte in 1914 were impeded by interruptions, which naturally caused a reduction in output on the part of all companies and lessened materially the development of the district.

The year opened auspiciously, with all the companies working practically to full capacity, a fair demand for copper, and a fair price being obtained for it. Before the middle of the year was reached, however, labor trouble between two factions of the miners' union, which had given no warning whatsoever before its appearance, became active and the general condition became so acute that the local authorities were unable to cope with the situation, and the Governor of Montana found it necessary to send the militia to Butte to curb the lawlessness which had arisen. The troops were withdrawn during the latter part of November and affairs assumed a normal aspect.

As the European war caused a serious decline in the exports of copper from the United States, all of the operating companies in Butte deemed it good policy to curtail their output by 50%, and after the early part of August the monthly output of copper from the Butte district was practically but one-half of the rate in the first six months of the year.

The East Butte, Pilot Butte, Tuolumne and Alex Scott properties ceased operations pending an improvement in general conditions. The Butte & Superior properties were operated fairly continuously, as the price for zinc was less affected than the price for copper, but toward the latter part of 1914 this company was compelled to shut down in order to make necessary repairs to the hoisting shaft. The zinc concentrator owned and operated by W. A. Clark was worked continuously on ores from the Elm Orlu mine, and, it is stated, with excellent results. The officials of the Butte Duluth company expressed themselves as being well satisfied with the results of their leaching operations, which were carried on continuously.

*President, Anaconda Copper Mining Co.

The Anaconda Copper Mining Co. operated about one-half of its properties after August and made about one-half of its normal output. The smeltery, concentrating works and electrolytic refinery at Great Falls were closed early in August, while the output from the Washoe works for the remainder of the year was about two-thirds of normal, or 12,000,000 lb. per month, including custom ore.

The Anaconda, however, made normal progress with the new 2000-ton leaching plant and sulphuric-acid works, and also maintained the work of installing the coal-dust-fired reverberatory furnaces.

On account of local and foreign conditions, the development work of the district suffered.

The Copper-Smelting Works of North America

The accompanying table, corrected up to Dec. 1, 1914, gives the names of the companies engaged in copper smelting in the United States, Canada and Mexico, the situation of their works, the number of their smelting furnaces and the estimated annual capacity in terms of tons of charge, meaning ore and flux, but not including fuel. In most cases the data have been communicated to us by the operating companies. However, the figures should be taken as only approximately correct. Some companies may have figured their annual capacity on the basis of the year of 365 days, and others on the basis of 350 days, or something else. Anyway, annual capacity is a rather variable figure. In modern practice a rather large quantity of ore is reduced directly to copper by charging it into the converter along with matte.

COPPER SMELTING WORKS OF NORTH AMERICA

Company	Situation of Works	No. of Blast Furnaces	Annual Capacity	No. of Reverberatory Furnaces	Annual Capacity	No. of Converters	Annual Capacity in Ore (*a*)
American Smelting & Refining Co	Aguascalientes, Mex.	8	730,000	..	.....	4	(*b*)
American Smelting & Refining Co	Perth Amboy, N. J.	3	111,000	..	.....	2	(*b*)
American Smelting & Refining Co	Omaha, Nebr.	..	.....	..	.....	3	..
American Smelting & Refining Co	El Paso, Texas	3	250,000	3	420,000	3	(*b*)
American Smelting & Refining Co	Matehuala, S.L.P., Mex.	3	325,000	..	.....	..	..
American Smelting & Refining Co	Hayden, Ariz.	..	.....	2	290,000	3	(*b*)
American Smelters Securities Co	Garfield, Utah	4	800,000	6	875,000	6	(*b*)
American Smelters Securities Co	Tacoma, Wash.	2	420,000	..	.....	6	(*b*)
American Smelters Securities Co	Velardeña, Dgo., Mex.	3	227,500	..	.....	..	..
Anaconda Copper Mining Co	Anaconda, Mont.	3	1,800,000	8	800,000	12	85,000
Anaconda Copper Mining Co	Great Falls, Mont.	5	800,000	3	250,000	3	34,500
Arizona Copper Co	Clifton, Ariz.	..	.....	3	360,000	3	.....
Balakala Consolidated Copper Co (*h*)	Coram, Calif.	3	630,000	1	52,500	2	.....
Compagnie du Boleo	Santa Rosalia, Mex.	8	650,000	..	.....	..	.....
British Columbia Copper Co	Greenwood, B. C.	3	700,000	..	.....	2	.....
Calumet & Arizona Mining Co	Douglas, Ariz.	2	634,900	4	471,700	6	40,500
Canadian Copper Co	Copperciff, Ont.	6	940,000	2	300,000	5	(*g*)
Cananea Consolidated Copper Co	Cananea, Son.	8	868,000	2	153,000	6	35,000
Consolidated Arizona Smelting Co	Humboldt, Ariz.	..	.....	1	50,000	1	3,000
Consolidated Mining & Smelting Co	Trail, B. C.	5	450,000	..	.....	..	.....
Copper Queen Consolidated Copper Co	Douglas, Ariz.	10	1,225,000	3	275,000	7	34,160
Detroit Copper Mining Co	Morenci, Ariz.	1	132,657	..	.....	3	7,578
Ducktown Sulphur, Copper & Iron Co	Isabella, Tenn.	2	171,500	..	.....	..	.....
East Butte Copper Mining Co	Butte, Mont.	2	310,250	..	.....	3	7,300
Granby Consolidated Mining, Smelting & Power Co	Grand Forks, B. C.	8	1,440,000	..	.....	6	7,000
Granby Consolidated Mining, Smelting & Power Co	Anyox, B. C.	3	700,000	..	.....	3	.....
International Smelting Co	Tooele, Utah	..	.....	5	456,250	5	25,450
International Smelting Co	Miami, Ariz (*d*)	..	.....	3	262,500	5	.....
Mammoth Copper Mining Co	Kennett, Calif.	5	730,000	..	.....	2	18,250
Mason Valley Mines Co	Thompson, Nev.	2	800,000	..	.....	2	22,000
Mazapil Copper Co (*h*)	Saltillo, Coah., Mex.	4	350,000	1	52,500	4	.....
Mond Nickel Co	Coniston, Ont.	3	630,000	..	.....	3	70,000
Mountain Copper Co	Martinez, Calif.	..	.....	3	125,000	2	(*g*)
Nevada Consolidated Copper Co	McGill, Nev.	1	175,000	5	900,000	4	40,000
Nichols Copper Co	Laurel Hill, N. Y.	2	94,500	..	.....	2	.....
Old Dominion Copper Mining & Smelting Co	Globe, Ariz.	5	562,500	..	.....	3	8,400
Orford Works, International Nickel Co	Constable Hook, N. J.	2	94,500	..	.....	3	.....
Ouray Smelting & Refining Co	Ouray, Colo.	2	350	..	.....	..	.....
Penn Mining Co	Campo Seco, Calif.	1	50,000	2 (*e*)	48,000	..	.....
Pioneer Smelting Co	Corwin, Ariz.	1	60,000	..	.....	..	.....
Santa Fe Gold & Copper Co	San Pedro, N. M.	1	52,500	..	.....	..	.....
Shannon Copper Co	Clifton, Ariz.	3	500,000	..	.....	2	8,000
Swansea Consolidated Gold & Copper Mining Co	Bouse, Ariz.	1	190,000	..	.....	2	.....
Tennessee Copper Co	Copperhill, Tenn.	7	1,000,000	..	.....	4	15,700
Teziutlan Copper Mining & Smelting Co. (*h*)	Teziutlan, Puebla, Mex.	2	350,000	..	.....	3	.....
Cia. Metalurgica de Torreon	Torreon, Coah., Mex.	2	175,000	..	.....	2	.....
Tyee Copper Co. (*h*)	Ladysmith, B. C.	2	175,000	..	.....	..	.....
U. S. Metals Ref. Co.	Chrome, N. J.	2	200,000	..	.....	2	.....
U. S. Smelting Co. (*h*)	Midvale, Utah	6	670,000	1	40,000	4	36,000
Virginia Smelting Co	West Norfolk, Va. (*f*)	1	200,000	..	.....	..	.....
United Verde Copper Co. (*c*)	Jerome, Ariz.	4	427,300	..	.....	4	37,600
United Verde Copper Co	Clarkdale, Ariz (*d*)	4	720,000	3	285,000	5	75,000

a Raw ore smelted as flux. *b* Included in furnace tonnages. *c* To be abandoned by Jan. 1, 1915. *d* Plants building. *e* Penn Min. Co. has 2 reverberatories, each with capacity of 48,000 tons per annum, but only one is run at a time. *f* Operated by Norfolk Smelting Co., Inc. *g* No raw ore charged. *h* Not in operation.

Copper in Arizona

By James Douglas*

During 1914 Arizona shared the fate of the world at large. The preliminary statistics for 1914, as compared with 1913, show that prior to the breaking out of the war the state was fully maintaining its standard production. In fact, it probably exceeded the production of the first seven months of 1913, which was 220,000,000, by about 30,000,000 lb. Subsequent to July the sudden cessation of shipments abroad and the stagnation of business in this country forced upon the copper companies a reduction of production which, compared with a similar period of last year, amounts probably to 75,000,000 or 80,000,000 pounds.

The vacillating demands during the past few months, of both the home and the foreign market, make it impossible to forecast the future, and therefore to predict the resumption of work at full speed. But the large companies have adjusted themselves to the altered conditions, and at the principal centers of the copper industry in the state there does not seem to be either distress or confusion. Fortunately, the sudden reduction in production, with its inevitable discharge of labor, occurred at a period when in California, Kansas and Colorado there was urgent demand for labor, which therefore dispersed and was absorbed elsewhere.

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The suddenly arrested activity, and the relief, therefore, of the strain and high pressure under which the officers of the companies were working, enabled the operating staffs in most cases to study improved methods with deliberation and calmness, which in the long run will compensate, in diminished costs of production, for the temporary relaxation of output.

As even prior to the breaking out of the war there was not much exhilaration in the copper trade, no inducement to expand existed. The United Verde company was already reconstructing its works on a larger scale in a more convenient situation. They are now approaching completion. The Inspiration is still erecting its magnificent mining and milling equipment, and the neighboring plant of the International Smelting & Refinng Co., which will probably smelt all the concentrates made in the Globe district, is being pressed toward completion, and should be in blast before the end of 1915.

The only new large project in contemplation is the development of the property of the New Cornelia Copper Co., in the Ajo district. It is controlled by the interests prominent in the Calumet & Arizona Mining Co., and as the mining and metallurgy will be conducted under the able staff of that organization, some interesting departures from recognized methods may be anticipated. The ores are of low grade and are partly oxidized and partly sulphureted, and as the companies have in their Calumet & Arizona mines ores whose ingredients can be applied to the extraction of the Ajo copper, the investigations and experiments are therefore being made along more or less original lines. An experimental plant is also being operated by the Copper Queen at Douglas in the interest of Phelps, Dodge & Co.

The mill problem everywhere is to save the copper carried away in the very fine slimes from the tables and its solution is sought in a combination of electrolytic deposition with leaching. This has revived interest in the hydrometallurgy of copper; but the choice will probably lie between leaching and flotation, both of which must be considered to be still in the experimental stage.

The Copper Queen company has, after relying exclusively for 34 years on its smelting ores, to resort to concentration. It is developing what once would have been considered a fairly large body of concentrating ore in the porphyries of Sacramento Hill, but today, when quantities of ore are counted by the tens of millions of tons instead of hundreds of thousands, it is of insignificant size. Nevertheless, it warrants the construction of a concentrator, whose general features are under consideration.

The most interesting novelty introduced of late in some of the mills has been the National riffle, applied to the Wilfley tables. They have even displaced in some places both jigs and trommels. The large production of the International reverberatories, when they are lighted, will still further throw into the background the cupola, on which for so long the Arizona smelter exclusively relied. Another innovation has been in the substitution of the basic lining of the bessemer converter for the acid lining. It has reduced the cost of smelting and has had a notable influence on mining by diminishing the demand for certain classes of siliceous ores.

ELECTROLYTIC COPPER REFINERIES OF THE UNITED STATES

Works	Situation	1911 Capacity, Pounds	1912 Capacity, Pounds	1913 Capacity, Pounds (c)	1913 Capacity, Pounds (c)
Nichols Copper Co.	Laurel Hill, N. Y.	(b) 330,000,000	(a) 400,000,000	400,000,000	400,000,000
Raritan Copper Works	Perth Amboy, N. J.	(a) 320,000,000	(b) 360,000,000	400,000,000	400,000,000
Baltimore Copper Smelting & Rolling Co.	Canton, Md.	(b) 288,000,000	(a) 312,000,000	348,000,000	336,000,000
American Smelting & Refining Co.	Perth Amboy, N. J.	(b) 180,000,000	(a) 192,000,000	216,000,000	216,000,000
U. S. Metals Refining Co.	Chrome, N. J.	(a) 180,000,000	(a) 180,000,000	200,000,000	200,000,000
Balbach Smelting & Refining Co.	Newark, N. J.	(a) 48,000,000	(a) 48,000,000	48,000,000	48,000,000
Anaconda Copper Mining Co.	Great Falls, Mont.	(b) 65,000,000	(a) 65,000,000	65,000,000	65,000,000
Tacoma Smelting Co.	Tacoma, Wash.	(b) 28,000,000	(a) 36,000,000	36,000,000	48,000,000
Calumet & Hecla Mining Co.	Buffalo, N. Y.	(a) 55,000,000	(a) 55,000,000	55,000,000	(d)
Calumet & Hecla Mining Co.	Calumet, Mich.	.....	.....	.....	(e) 65,000,000
Total	.....	1,494,000,000	1,648,000,000	1,768,000,000	1,778,000,000

a Official figures furnished by the respective companies. b Estimated. c All of the figures for 1913 and 1914 were officially furnished. d Buffalo works of Calumet & Hecla dismantled in fall of 1914. e New works put into operation in 1914.

Miami Copper Company in 1914

By J. Parke Channing*

During the first seven months of the year there was treated 749,269 tons of ore, from which, after allowing for losses in smelting and refining, 22,126,898 lb. of refined copper was produced. In the early part of August, on account of the war in Europe, the production was materially decreased, the figures for the last five months, however, not yet being available.

The ore mined during the year was all obtained above the 420-ft. level, a large proportion coming from the northwest orebody, where mining was originally started on the room-and-pillar system. Actual work in this section was confined to breaking the pillars; this was completed early in the year and the ore produced was obtained almost entirely by drawing the broken ore. In the eastern portion of the mine, the ore was extracted by means of slicing and considerable improvement was made in the methods of doing this work by dividing the ore into areas 200 ft. square, with a well protected supply raise in the center, from which the block was opened up by drifting and the ore extracted by retreating from the outside boundaries back to the central raise. This method has resulted in a considerable reduction in the cost of this class of work.

Development work during the year amounted to 22,850 ft. and consisted entirely of opening up the Captain orebody, preparatory to actual stoping operations. It is planned to take this ore out in two lifts, the upper one consisting of the ore above the 270-ft. level, which will be used as a transfer level, from which the ore will be sent to the main tramming level. Development work consisted of opening out this level and sublevels above, and of putting up transfer raises from the 420-ft. tramming level to the transfer level. The work was advanced sufficiently to start the actual stoping in the month of May, and one room was completed up to the time the curtailment of output took place early in August, at which time the work was discontinued. In mining this orebody narrow rooms and pillars will be used.

During the first half of the year plans were made for further prospecting the orebody in depth, but on account of the reduction in output the work was not undertaken

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and ore reserves will therefore show no increase. The tonnage opened up at the end of the year amounted to approximately 20,000,000 tons of ore, averaging 2.45% copper; 17,000,000 tons of low-grade ore, averaging 1.21%, and 6,000,000 tons of mixed oxide and sulphide ore, averaging 2% copper. In opening up the Captain orebody for mining work, the original estimate of tonnage based on churn drilling have so far been exceeded, and it is also found that the grade will average better than the original estimate.

The Lake Superior Copper District, 1914

By C. L. C. Fichtel*

The year 1914 was a most trying one for the Lake Superior copper district. The companies and employees were just getting nicely squared away from the effects of the strike of the Western Federation of Miners, when the European war broke out, demoralizing the copper market and forcing a general curtailment of the working forces and a lowering of wages.

The strike was officially called off in April. Although the mines had been working at full force for some months previous to this, it had cost a lot of money, and during the early part of the year production was practically suspended, so that at the outbreak of the war, the companies were not in good financial condition to withstand this serious handicap. A general reduction of 10% was made in wages, and the Calumet & Hecla Mining Co. and subsidiaries went on three-quarter time Sept. 1, and the Copper Range mines on half time, working two weeks and shutting down completely for the remaining two weeks in each month. A number of the smaller companies suspended operations completely and as a result there were a number of unemployed men throughout the district. Production was reduced in about direct proportion with the exception of a possible slight increase in the efficiency of the working force and a little larger production per man employed.

The Keweenaw Copper Co. carried on development work at the Phœnix property on the Ashbed lode; the shaft was put down several hundred feet and drifts extended from the various levels. The formation is flat and comparatively wide and the copper contents most encouraging. The Wolverine and Mohawk properties were operated full time during the latter part of the year when the other mines were working at reduced time. This was consistent because the output of these mines is taken for trade in the United States.

The Tamarack Mining Co. suspended operations at the mine completely with the exception of pumping. Plans were laid for working over of the tailing piles and a large structural-steel building is about completed, which will be used for a regrinding and concentrating plant. This plant when completed will contain 32 Hardinge mills.

The Calumet & Hecla Mining Co. put into commission its electrolytic plant at Hubbell and discontinued the Black Rock smelting works at Buffalo, and is treating all the electrolytic copper for its mines and subsidiaries at this plant.

The first portion of the No. 2 regrinding plant consisting of 16 Hardinge mills together with their complement of tables went into commission during the summer. The 20-in. hydraulic dredge that will be used in the reclamation of the tailing piles was completed and given a trial run and worked well. All construction work was stopped at the outbreak of the war and nothing further was done toward the completion of this plant. The company laid plans for a leaching plant and the excavations were started, but this also was stopped and the contract for the structural steel was canceled. A central employment bureau was established through which all the men for the Calumet & Hecla plants and all subsidiary companies will be handled.

The Osceola company started work on the foot-wall formation at the main mine and had a new shaft house nearly completed at the No. 3 shaft, which has been idle for a number of years, when the curtailment went into effect. Nothing was done at the Laurium property during the year and the La Salle company suspended operations, as did also the Hancock, with the exception of pumping.

The Superior Copper Co. lost the boiler and compressor house at its No. 1 shaft through fire, which necessitated the shutting down of the mine for about three weeks.

The Copper Range Consolidated Mining Co. carried on normal operations until about Sept. 1, when it went on half time. During the year, one of the largest masses of copper discovered in the district has been uncovered in the Trimountain mine; it was first encountered between the 24th and 25th levels and has been uncovered down to the 27th level and extends along the lateral for about 40 ft. with an average thickness of about 8 inches.

The Winona company suspended operations, but a party of former miners worked the property on tribute and succeeded in making a fairly good showing, shipping the rock to the No. 2 mill of the Lake Milling, Smelting & Refining Co.'s plant.

The White Pine Copper Co. in Ontonagon County, which is under the control of the Calumet & Hecla Mining Co., carried on operations throughout 1914 in a consistent manner. Two shafts were opened and the formation developed was rich. A 1000-ton mill is in course of erection and will go into commission in 1915.

*Electrical engineer, Calumet & Hecla mines, Houghton, Mich.

World's Consumption of Copper

(Metric Tons)

(From statistical report of the Metallgesellschaft, Frankfurt am Main)

Europe	1911	1912	1913
Germany	222,500	231,700	259,300
Great Britain	159,100	144,700	140,300
France	95,700	98,500	103,600
Austria-Hungary	38,500	48,200	39,200
Russia	32,800	40,000	40,200
Italy	29,400	34,200	31,200
Belgium	13,500	15,000	15,000
Netherlands	1,000	1,000	1,000
Other European countries	10,000	10,200	*a* 13,300
Total consumption in Europe	602,500	623,500	643,100
America			
United States	321,900	371,800	348,100
Others in America	3,000	3,000	3,000
Total consumption in America	324,900	374,800	351,100
Asia, Australia, Africa			
Production Japan and Australia	95,000	111,900	119,000
Imports from Europe	500	1,400	1,000
Imports from America	.....	500	80
Total	95,500	113,800	120,100
Exports to Europe and America	68,800	73,400	69,800
Consumption in Asia, Australia and Africa	26,700	40,400	50,300
World's consumption	954,100	1,038,700	1,044,500
World's production	893,800	1,018,600	1,005,900

a Estimated

Lead

The outstanding feature in the American lead industry in 1914 was the unparalleled exportation, which was, in fact, the only thing that saved the lead producers from disaster. Production increased both in Idaho and Missouri, and was maintained at undiminished rate in spite of unsatisfactory domestic consumption. However, troubles in Mexico had deprived Europe of her supply of lead from that source and in the early part of 1914 Europe was a large buyer of American lead to make good the deficiency, about 20,000 tons being exported during that period. In the latter part of 1914 the war created a new demand for American lead, there being a very large exportation to Russia, which had lost its normal supply from Germany. In spite of those saving conditions the price for lead declined to 3½c. per lb., New York, and would have gone lower had not the Idaho and Missouri producers finally curtailed. The natural explanation of their previous reluctance to curtail is that they were realizing large profits even at the low prices, and, indeed, there is reason to believe that the Idaho and Missouri lead costs only about 2½ to 3½c. to produce.

PRODUCTION OF LEAD (REFINERY STATISTICS) (a)

(In Tons of 2000 Lb.)

Domestic: Class	1911	1912	1913	1914
Desilverized	211,041	236,207	261,616	318,286
Antimonial	8,916	9,239	16,345	15,642
S. E. Missouri	155,008	145,366	133,203	177,320
S. W. Missouri	25,993	19,224	22,312	22,125
Totals	400,958	410,036	433,476	533,373
Foreign:				
Desilverized	89,487	82,715	54,774	24,624
Antimonial	4,929	5,003	2,300	543
Totals	94,416	87,718	57,074	25,167
Grand totals	495,374	497,754	490,550	558,540

(a) These figures include the lead derived from scrap and junk by primary smelters.

WORLD'S PRODUCTION OF PIG LEAD

(Metric Tons)

(From statistical report of the Metallgesellschaft, Frankfurt am Main)

	1911	1912	1913
Spain (a)	175,100	186,700	203,000
Germany	164,400	176,600	181,100
France	23,600	31,100	c 28,000
Great Britain	26,000	29,200	30,500
Belgium	44,300	51,200	50,800
Italy	16,700	21,500	21,700
Austria-Hungary	19,600	21,400	24,100
Greece	14,300	14,500	18,400
Sweden and Norway	1,100	1,300	1,500
Russia	1,000	c 1,000	c 1,000
Asiatic Turkey	12,400	12,500	13,900
Total Europe [b]	498,500	547,000	574,000
United States	377,900	387,300	407,800
Mexico	124,600	c 108,000	c 62,000
Canada	10,700	16,300	17,100
Total North America	513,200	511,600	486,900
Japan	4,200	3,600	c 3,600
Australia	99,600	107,400	116,000
Other countries	20,500	12,200	6,200
Total world's production	1,136,000	1,181,800	1,186,700

a Exports. b Including Asiatic Turkey. c Estimated.

The Mexican producers of lead were idle during the most of 1914, because of the internal troubles of that country, but late in the fall the plants of the A. S. & R. Co. and of the Peñoles company were put in operation.

WORLD'S CONSUMPTION OF LEAD

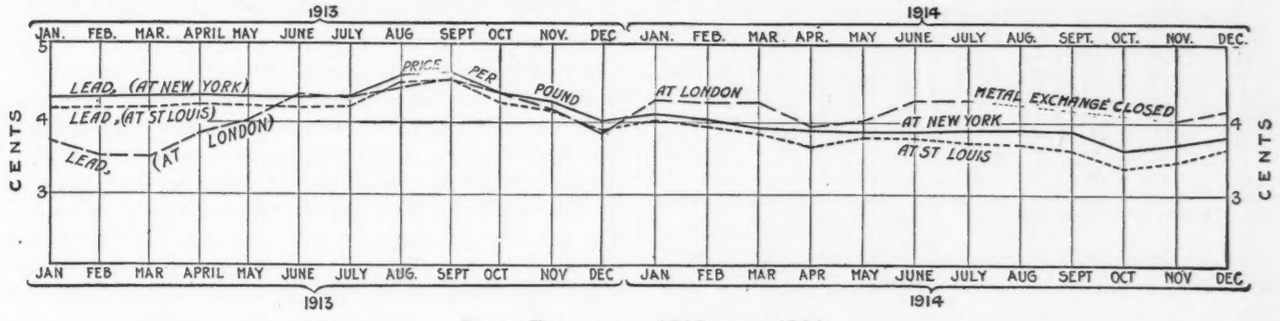
(Metric Tons)

(From statistical report of the Metallgesellschaft, Frankfurt am Main)

	1911	1912	1913
Germany	232,900	232,100	223,500
Great Britain	198,300	196,300	191,400
France	99,600	104,700	107,600
Russia	42,900	45,600	58,800
Belgium	43,000	44,900	42,900
Italy	36,300	33,000	32,600
Austria-Hungary	36,200	37,800	35,500
Holland a	6,800	6,300	9,500
Switzerland	5,000	6,400	5,800
Other European countries	3,500	4,400	6,300
Total Europe	704,500	711,500	713,900
United States	364,400	398,400	401,300
Canada	21,100	30,000	22,900
Japan	18,900	21,800	a 18,500
Australia	9,100	10,100	9,600
Other countries	31,200	30,000	a 30,000
Total world's consumption	1,149,200	1,201,800	1,196,200

a Estimated.

The small importation of lead in bond and reëxportation thereof in 1914, as compared with 1913 and previous years, was due especially to the cessation of mining and smelting in Mexico. The deficiency in European supply was made good by the exportation of domestic lead, the total exports of the year being about 60,000 tons. The large increase in the domestic production permitted this to be done.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JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
CENTS
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LEAD, (AT NEW YORK)
LEAD, (AT ST LOUIS)
LEAD, (AT LONDON)
PRICE PER POUND
AT LONDON
METAL EXCHANGE CLOSED
AT NEW YORK
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JAN FEB MAR APRIL MAY JUNE JULY AUG. SEPT OCT NOV DEC
JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT NOV DEC
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LEAD PRICES IN 1913 AND 1914

The Lead Market in 1914

First Quarter—The market opened with lead 4.15c., New York, following an advance by the A. S. & R. Co., on Dec. 29, 1913. The advance proved, however, to be premature and on Jan. 9 the price was reduced to 4.10c. This stimulated buying and on Feb. 2 the price was advanced again to 4.15. Something wrong with the market was apparently discovered, inasmuch as immediately after this second advance the independent producers began to shade the price and take the business, recognizing which the A. S. & R. Co. made a reduction to 4c. on Feb. 11. At the lower level an increased business was done. Through this period the London market, where the absence of Mexican supplies had become keenly felt, was persistently strong, and early in March the disparity of prices permitted the sale of some tonnage of Missouri lead for export. This was the beginning of a very important export business. Domestic demand having failed to improve and some pressure to sell Missouri lead having de-

veloped, the A. S. & R. Co., on Mar. 25, reduced its price to 3.90c., New York, and on Mar. 30 reduced it again to 3.80c., New York. The lower figures interested buyers and some round tonnages were turned over.

Second Quarter—During April the market was without special features until nearly the end of the month, when consumers apparently made up their minds that the threatening conditions in Mexico tended to strengthen the positions here and that the price for lead was low anyway. The extent of their buying induced the A. S. & R. Co. to raise its price to 3.90c. on Apr. 27. May and June passed without any especially noteworthy features. A large export trade in domestic lead was done right along.

Third Quarter—Early in July a rather pronounced weakness began to develop in the lead market and it became more clearly recognized that something was radically wrong, viz., the maintenance of a huge production. Had it not been for the large exportation to Europe the danger signals would have been flying earlier. However, even in the face of this subtraction from our supply, the unsold stocks in the hands of producers were accumulating rapidly.

MONTHLY AVERAGE PRICE OF LEAD

	New York			St. Louis			London		
Month	1912	1913	1914	1912	1913	1914	1912	1913	1914
Jan.	4.435	4.321	4.111	4.327	4.171	4.011	15.597	17.114	19.665
Feb.	4.026	4.325	4.048	3.946	4.175	3.937	15.738	16.550	19.606
Mar.	4.073	4.327	3.970	4.046	4.177	3.850	15.997	15.977	19.651
Apr.	4.200	4.381	3.810	4.118	4.242	3.688	16.331	17.597	18.225
May	4.194	4.342	3.900	4.072	4.226	3.808	16.509	18.923	18.503
June	4.392	4 325	3.900	4.321	4.190	3.810	17.588	20.226	19.411
July	4.720	4.353	3.891	4.603	4.223	3.738	18.544	20.038	19.051
Aug.	4.569	4.624	3.875	4.452	4.550	3.715	19.655	20.406	*
Sept.	5.048	4.698	3.828	4.924	4.579	3.658	22.292	20.648	*
Oct.	5.071	4.402	3.528	4.894	4.253	3.384	20.630	20.302	*
Nov.	4.615	4.293	3.683	4.463	4.146	3.585	18.193	19.334	18.500
Dec.	4.303	4.047	3.800	4.152	3.929	3.662	18.069	17.798	19.097
Year	4.471	4.370	3.862	4.360	4.238	3.737	17.929	18.743	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton. * London Exchange closed.

It is understood that overtures were made to the Idaho producers to curtail at an early date, but that they were unwilling. During July the tone of the market weakened steadily, owing to the desire of many holders to liquidate their stocks, and this was reflected in the St. Louis price, although the A. S. & R. Co. maintained the New York price unchanged. The war cloud in Europe had no particular effect upon the American lead market, the situation having previously been bad, and when the general war was declared there was no such upset in lead as there was in copper. On the contrary, there was a feeling that the situation might be improved, both by increased demand for export and adverse effect upon production by the decline in silver. In fact the tone of the market for several weeks was rather stronger, but by September all faith in an advance on account of the war had been lost and some urgent desire to liquidate was exhibited. The fact was that not only the leading interest had a large unsold stock, but nearly all of the independent producers were in a similar position. The subsequent declining tendency of the market was simply explained by the desire of some producers to have money rather than lead. On Sept. 24, the A. S. & R. Co. bowed to the inevitable and reduced its price to 3.75c., New York, thus coming more nearly into step with the open market at St. Louis, which had previously stood at a price whereof the New York parity was 3.80c.

Fourth Quarter—The independent producers immediately began to undercut again, whereupon the A. S. & R. Co., reduced to 3.60c. on Oct. 5 and to 3.50c. on Oct. 7, these successive reductions temporarily producing something like demoralization in the market. The bald fact was that a price level had to be found that would move the unsold stock, or curtail production, or both. About the middle of October, the principal producers of Missouri and Idaho read the signs and curtailed production by 25 to 50%. This drastic curtailment impressed the minds of consumers, who began to buy largely and continued so to do right through November.

The extent of that buying justified an advance of the price to 3.60c. on Nov. 12, and to 3.70c. on Nov. 17. On Nov. 19, it was raised to 3.90c., but this was carrying the thing a little too far and on Nov. 27 the price was reduced to 3.80c. In September and October, there was a considerable export business not only to England, but also to remote countries like Japan and Russia, the last being a large buyer.

The prices for lead at New York, named by the A. S. & R. Co. during 1914 were as follows:

	Lb.		Lb.
Opened	4.15c.	Oct. 5	3.60c.
Jan. 9	4.10	Oct. 7	3.50
Feb. 2	4.15	Nov. 12	3.60
Feb. 11	4.00	Nov. 17	3.70
Mar. 25	3.90	Nov. 19	3.90
Mar. 30	3.80	Nov. 27	3.80
April 27	3.90		
Sept. 24	3.75		

White Lead and Oxides in 1914

Weather conditions over a large section of the country were unfavorable for painting during the winter and early spring months of 1914, and the result was that sales of all paints up to Apr. 1 were considerably below normal. The later improvement, however, was sufficient to offset the early losses, and so far as lead pigments are concerned the year showed a fairly satisfactory aggregate movement. The general depression in business has had no marked effect upon white lead, but the demand for oxides from some of the large consuming industries has been curtailed by a falling off in the sales of their products.

Prices did not follow closely the fluctuations in pig lead, although the marked decline on the latter in September and October gave a weak tone to the whole line of lead products.

Business in dry white lead was on the basis established prior to the opening of the year of 5¼c. to the largest buyers, until October, when a reduction of ¼c. was made and this promises to be the base price for 1915, unless there should be some violent fluctuations in pig lead. Neither buyers nor sellers are disposed to enter into long-time contracts, but such contracts as are made for any period are on the 5c. basis.

The price of white lead in oil was fixed in November, 1913, at 6¾c. to the largest buyers on all of the standard brands. This was a decline of ½c. from the highest prices of that year and was made following a break in pig lead and partly in anticipation of a further decline in the latter. This occurred later, but it had no effect upon white lead until the abnormally low figures were reached in October, when there were evidences of a disposition on the part of corroders to reduce the margin between their products and the metal, if there was any assurance of the latter remaining on its present low level. Their doubts upon this point were confirmed, however, by an advance of $8 per ton in the price of pig lead between Nov. 12 and 20.

A slight reaction occurred later, but apparently manufacturers hesitated to change the price of white lead in oil until there was some more definite development in regard to the probable course of the metal market.

Prices on oxides have been sagging for the last six months, the earliest depression having come as much from the apparent probability of competition from abroad, which has been made possible by the new tariff, as from the low price of pig lead here. Ordinary powdered litharge sold early in the year at 5¼c. in a large way, and later on 5c. was made the bottom figure, and at the close the range for large packages is 5 to 5¾c. as to quantity.

Red lead has sustained a more marked decline and is now quoted as low as 5½c. for the ordinary grades and up to 6¼c. for the high standards for structural or other special purposes. The European war has removed any immediate danger of foreign competition, and while the present low prices are based chiefly on the cost of pig lead, they are also influenced by a diminished demand from the large consuming industries and an excessive domestic production.

The practical closing of European sources of supply has resulted in an increased demand for white lead and the oxides for export, not only to neutral countries, but also to the belligerent nations which are unable to draw upon their usual sources. There is reason to hope that some of this trade will outlive the war, but manufacturers here do not feel confident of their ability to compete with foreign labor and other costs, under normal conditions.

Linseed oil has not reached extremes which have affected the price of lead in oil either way. To large consumers the price during the first half of the year was from 50 to 52c., with a considerable advance in July on the prospect of a short seed crop. This was more than offset by the subsequent depression, however, and the close is at about 46c.

The Coeur d'Alenes during 1914

By Stanly A. Easton*

The Cœur d'Alene lead, silver, zinc and copper district of Shoshone County, Idaho, as a whole undoubtedly suffered less from disturbed conditions during the latter part of 1914 than any other base-metal mining field in the Northwest or in British Columbia. The mines at Mullan, two of them copper producers, had to close early in the fall, but all the other producers of the district continued, some, however, on a more or less restricted production. So that while profits were badly cut into by the soft-metal markets, industrial conditions, while not good during the latter half of 1914, were better than in nearly all other neighboring districts.

New production and ore development have come from the important operations of the Consolidated Interstate-Callahan, Tamarack & Custer Consolidated in the Sunset and Nine Mile country, and the Caledonia Mining Co. in the Wardner field, the last beginning a splendid production in June because of the completion of arrangements for milling and transportation through the Kellogg tunnel, former production having come solely from shipments of high-grade crude ore and the products of close sorting and hand jigging.

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The treatment of slimes from the concentrators of the district for the recovery of the lead, silver and zinc formerly wasted has continued to receive systematic study and carefully organized investigation by all the producing companies and the results secured by flotation and its adaptations to the conditions to be met here are a notable metallurgical achievement. The Bunker Hill & Sullivan company has supplemented these improved wet concentration methods by further electro-chemical work, both on a laboratory and on a working scale, designed to produce metallic lead, silver and zinc, or the salts of these metals. The results are not yet conclusive, but are a distinct new development and of much interest and promise.

Deep development in all the older mines continues favorable and the new production and development noted above from virgin ground assures the importance of the Cœur d'Alenes as a producing field for the immediate future and probably for very many years to come.

From present estimates the banner year 1913, which gave 148,370 short tons of lead from the district, 36% of the United States domestic yield, has been exceeded by the 1914 production, curtailed as it was by partial closure and restriction, which shows: Gold, 4500 oz.; silver, 13,349,000 oz.; lead, 336,107,000 lb.; copper, 2,776,000 lb. and zinc, 48,472,000 lb.

The Silver-Lead Smelting Works of North America*

The accompanying list gives the several silver-lead smelting works of the United States, Mexico and Canada, together with the number of their furnaces (in all cases, blast furnaces), and their estimated annual capacity in tons of charge. By "tons of charge" we mean ore and flux, but exclude coke. The ton of charge is manifestly the correct unit. In the case of a self-fluxing ore, the ton of ore smelted and the ton of charge smelted is the same thing. In other cases, fuel and labor have to be used in smelting the flux as well as in smelting the ore, and the economy of smelting depends largely upon the percentage of ore in the charge. The management of this question is about the highest exercise of the metallurgist's skill.

SILVER-LEAD SMELTING WORKS

Company	Place	Furnaces	Annual Capacity (a)
American Smelting & Refining Co.	Denver	7	511,000
American Smelting & Refining Co.	Pueblo	7	380,000
American Smelting & Refining Co.	Durango	4	146,000
American Smelting & Refining Co.	Leadville	10	509,000
American Smelting & Refining Co.	Murray	8	657,000
American Smelting & Refining Co.	East Helena	4	306,600
American Smelting & Refining Co.	Omaha (c)	2	82,000
American Smelting & Refining Co.	Chicago (c)	2	60,000
American Smelting & Refining Co.	Perth Amboy(c)	3	140,000
American Smelting & Refining Co.	El Paso	7	380,000
Selby Smelting & Lead Co.	Selby	3	210,000
Ohio & Colorado Smelting Co.	Salida, Colo.	4	345,000
U. S. Smelting Co.	Midvale, Utah.	6	500,000
Needles Smelting Co.	Needles, Cal.(d)	2	70,000
Pennsylvania Smelting Co.	Carnegie, Pa.	2	60,000
International Smelting Co.	Tooele, Utah.	5	500,000
Totals, United States		76	4,856,600
American Smelting & Refining Co.	Monterey	10	475,000
American Smelting & Refining Co.	Aguascalientes	2	100,000
American Smelting & Refining Co.	Chihuahua	5	274,000
American Smelters Securities Co.	Velardena	3	140,000
Compania Metalurgica Mexicana	San Luis Potosi	11	385,000
Compania Metalurgica de Torreon	Torreon	8	360,000
Compania Minera de Peñoles	Mapimi (d)	6	325,000
Totals, Mexico		45	2,059,000
Consolidated Mining & Smelting Co.	Trail, B.C.	3	110,000

a Tons of charge. c Smelt chiefly refinery between products. d Not operated in 1914.

*Corrected to Dec. 1, 1914.

communications of the respective companies. Estimated capacity is, however, always a matter of more or less uncertainty, and for this reason, if for no other, the figures that we give ought to be accepted only as approximations. Our figures have been corrected from last year, but the totals remain about the same. There was in fact no new construction of consequence in 1914.

The total capacity of the Mexican works is a little over 2,000,000 tons per annum; of the American works, a little over 4,800,000 tons. With respect to the American works, at least, such capacity has never been in use at one time. More or less of it represents capacity that has become idle because of changes in the conditions of ore supply.

The Southeastern Missouri Lead District in 1914

By H. A. Wheeler*

The Southeastern or disseminated-lead district of Missouri produced about 163,000 tons of lead in 1914 with an approximate value of $13,000,000. This is a new high record and reëstablishes the consistent growth that this premier lead camp has shown for many years and which was only interrupted in 1913 as the result of a strike. The 1914 output exceeds that of 1913 by about 26,000 tons and that of 1912, the prior record output, by 16,000 tons, or about 10 per cent.

That the 1914 output should show an important increase is especially noteworthy, as the leading producers curtailed their output 20 to 25% during the last quarter of the year, on account of the severe depression, while no new mines were opened—in fact, fewer shafts than usual were operated. This growth is mainly due to improved operating efficiency, in which the flotation process has been an important factor. The district has just passed through the most trying year in its history as regards profits, as the lead market was abnormally depressed, especially in the latter half of the year, while labor was paid the highest rates that ever ruled in this district. These conditions had a highly stimulating effect in improving the working efficiency, one of the results of which is that lower-grade ores are being worked than ever before. The lack of walls or defined limits to the disseminated orebodies has always imposed a big responsibility on the mining captain as to when to cease mining, as the ore gradually dies out in the surrounding dolomite, and it is largely a matter of experience and conditions as to where to draw the line between pay ore and rock that is too low-grade. With the improved operating efficiency, many abandoned stopes are being successfully reworked, in spite of the low-grade tenor of the ore, and the average lead yield of the ore now being mined probably approximates 3%, as compared with former averages of 3.4 to 4%. While all the mines have runs or shoots that assay from 5 to 15%, there is now such a large amount of ore being extracted that will yield about 2%, that the average of the district may be estimated at 3% lead, after deducting milling and smelter losses.

An important feature of 1914 was the successful introduction of the flotation process, which has now been adopted by all the large producers. While there is considerable variation in the recovery at the different mills, they are all effecting a marked saving from the slimes that hitherto have been largely or entirely lost. The process was introduced at the Federal mill, under the guidance of H. A. Guess, the concentration specialist, and subsequently adopted and modified by the other companies. Oil of creosote is employed as the selective medium, and the concentrates assay about 50% lead after drying.

The labor situation, aside from being at maximum wages, was otherwise satisfactory during 1914, as it was plentiful and much more efficient. Many of the outlying shafts were closed down and the ore tonnage maintained by concentrating at the more central mines. This resulted in many of the men being laid off with resulting increase in the efficiency of those remaining at work, besides the ability to weed out the "lame ducks." As wages were forced up about 10% by the strike of 1913, it is quite likely that they will be reduced at least that much this winter.

The depressed condition of the lead market was felt in a total cessation of prospecting and only a few diamond drills were operated to maintain the development of the present orebodies. Even the important discovery of disseminated lead near Potosi, in Washington County, made at the close of 1913, was not followed up by the local parties who did the drilling, although it is said that they have materially increased their acreage.

The output of "shallow-lead" from the innumerable "diggings" in Washington, Jefferson and Franklin counties, which adjoin St. Francois County on the west and north, was almost negligible, as "gophering" is only active under the stimulus of good prices.

Over 95% of last year's output was produced by five companies in St. Francois County, which still retains its paramount importance as the main producer of the disseminated lead belt (as also of Missouri). There are several other small companies that are in the prospecting stage, but they did not attempt any development work last year.

The year 1914 was one of the most eventful in the history of the St. Joseph Lead Co., and its close finds it in a stronger, healthier, more promising condition than for a long time. The internal storms that started the previous year resulted in many salutary changes, not the least important of which was a complete reorganization in the technical department that resulted in greatly improved efficiency. The closely affiliated Doe Run Lead Co. was taken over and absorbed by the St. Joe company on a stock basis, which now makes this company by far the largest lead-producing unit in the country, while marked economies resulted from the consolidation.

Most of the outlying shafts of the St. Joe were shut down and mining has been concentrated at old No. 1 shaft at Bonne Terre, and at the Leadwood shaft. As the old mill is at the former and the new 2000-ton mill at the latter, this has dispensed with the ore trains, besides temporarily annulling the small outlying mining units. Similarly, the mining has been concentrated in the Doe Run department to three shafts, all of which are close to the new mill.

The old mill at Bonne Terre has again been remodeled and equipped with Hancock jigs, while the "chats" or tailings are now loaded mechanically. With its new flotation equipment, this veteran mill would no longer be recognized by its design; so completely has it been al-

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tered. It was built in 1883 as a 500-ton unit on lines that were unique and largely evolved from local ideas and experience. At that time it was the largest concentrator in the country, outside of the Lake copper mills, and with its Parson jigs and Parson-Rittinger side-bump tables, it was a great success from the start. It has been enlarged and remodeled several times since then, and today it is a modern 1500-ton mill in its equipment, although greatly handicapped by a building that was designed for a radically different system of concentration.

The new Doe Run mill has been enlarged to 4000 tons daily capacity and now treats the output from all the Doe Run mines, as the two older mills have been abandoned. At the smelting works at Herculaneum, the extensive series of dust-chambers and baghouse were completed and are in successful operation, after being delayed by a fire. Part of the output will be desilverized this year and put on the market as a "corroding" lead for which it is admirably adapted, as it is free from bismuth. An excellent description of this plant, illustrated by photographs, was recently published in the JOURNAL of Nov. 21, 1914.

The Federal Lead Co. continues to be a large producer, being only exceeded by the new combined output of the former St. Joseph and Doe Run companies. Since the introduction of the flotation process for treating the slimes, the canvas tables that were formerly employed have been abandoned. The central power plant has been increased by three new boilers that are equipped with chain grates and a 800-kw. Allis-Chalmers horizontal turbine. This enables the pumping at Nos. 4 and 7 mines to be done with electric pumps, and three triplex Aldrich pumps have been installed at No. 7 shaft that have an individual capacity of 1250 gal. per min. An interesting test was made last year with a mechanical mine shoveler that was operated by electricity, to try to reduce the high cost of hand shoveling. With its high maintenance cost, large percentage of time lost by delays and the relatively small size of the stopes and consequently limited tonnage, it did not prove a financial success. It was an important pioneer test and after the machine has been remodeled, it has much promise where the conditions are favorable.

The Desloge Lead Co. operated its mining and milling departments to full capacity until the latter part of 1914, when the output was reduced about 20% to meet the depression. The flotation process was successfully introduced, and an important recovery was effected from the slimes that had hitherto been lost. The new mine, No. 6, at Leadwood, was drowned out for about a month by the record-breaking cloudburst that did so much damage throughout the district last October.

The National Lead Co. had an active year, as in addition to its own output, it is milling and smelting the "Jake Day" ore from the St. Francois Lead Co. The flotation process was added to the slime department, with an important recovery of clear milling water beside the "floated lead." The lease on the extensive Mine la Motte estate was surrendered and its operation was taken over by another company.

The St. Francois Lead Co., which purchased the frequently condemned Jake Day land, had a successful year, as the ore averaged unusually high, while the increased development augmented the tonnage. Daily mill samples assayed from 7 to 12% and averaged over 9%. This company has not yet been provided with a mill, and its ore is being milled and smelted by the National Lead Co., after being hauled about 12 miles over the Missouri River & Bonne Terre Railroad.

MADISON COUNTY

Madison County, which adjoins St. Francois on the south, had only one active producer last year, the famous old Mine-la-Motte property, which turned out more lead than usual under a lease held by a new operating company.

The North American mine, at Fredericktown, is still closed down. When last operated, all the metals—lead, copper, nickel and cobalt—were recovered as sulphides. They are said to have aggregated 6% in metal contents and were worked into marketable products on the premises. The lead and copper predominated and as much as five tons per diem of ingot copper was produced. The Catherine mine, as also the adjoining Fleming property, have not been operated since the Federal Lead Co. surrendered its lease on same last year.

Molybdenum

At the beginning of 1914 molybdenum sold at about $1.45 per lb. After the war as high as $6 per lb. was realized for spot material. When the sudden war inquiries came in high prices were temporarily paid for spot ore. After that things quieted down, and the course of prices is now very difficult to foretell. Everything depends upon sudden inquiries for immediate shipment, and prices are made only from week to week.

In December there was a good market for wulfenite ore, providing it were free from injurious elements. This ore should contain at least 25% molybdenum oxide and should be free from copper, vanadium, tungsten, and chromium. Ore of such specifications brought about 60c. per lb. of molybdenum oxide.

Generally speaking, there appears to be an increasing demand for molybdenum, ferromolybdenum and molybdenum ore. It is said that, for certain purposes, molybdenum steel has been found to be decidedly superior to tungsten steel.

The Primos Chemical Co., which is a leading factor in this business and is the largest producer of tungsten ore in Colorado, is now engaged in developing a molybdenum mine near Georgetown, Colo. An old occurrence of mineralization was known at that place by a widespread yellowish stain of the rocks. This was lately found by representatives of the Primos Chemical Co. to be due to molybdenum, and that company acquired the property and is now going to build a concentrating mill of 50 tons daily capacity.

Selenium in 1914

The selenium market has been practically dead during 1914, owing to too fierce competition and overproduction in 1912 and 1913. It is believed that production has been carried on by only two companies and those at a reduced rate. Exports, so far as can be learned, have been about 14,000 lb.; the production of the United States we estimate at about 30,000 lb. Prices opened at $3@3.25 for large lots, and close nominally at $2@3. There seems to be no demand whatever for the metal at present and all deliveries being made are on old contracts.

Zinc

All of the American zinc-smelting companies reported their production to us, with the exception of one small company; estimating its output, the production in 1914 was about 360,000 tons, an increase of 2000 over the previous year.

Fifteen smelting companies reported by telegraph stocks on Dec. 31 aggregating 19,500 tons. Six companies reported works idle. Three operating companies, one very small, failed to report their stocks. Estimating 4000 tons for them, the total stock in the hands of smelters on Dec. 31 was 23,500 tons.

The zinc-smelting works in operation had 120,494 retorts at the end of 1914, compared with 110,218 at the end of 1913. Furnaces comprising the following number of retorts were under construction at the end of 1914: Matthiessen & Hegeler Zinc Co., 912; American Zinc & Chemical Co., Langeloth, Penn., 2592; Granby Mining & Smelting Co., E. St. Louis, Ill., 3240.

At the end of 1914 the active works were in many cases operated at only partial capacity. Thus, 20 plants reporting upon this subject showed an aggregate of 71,500 retorts in use on Dec. 15, out of a total of 85,592.

The zinc industry of the world was put at sixes and sevens by the outbreak of the war. Some of the consequences of this were the putting of most of the Belgian smelters out of business, the depriving of the German smelters of their foreign ore supply, the inability of the Broken Hill producers to market anything but a trifling proportion of their output, most of the Broken Hill mines being thereby compelled to suspend operations. The important zinc mines of Sardinia were similarly affected, but to a less extent, inasmuch as they were able to deliver ore to the French and British smelters as usual.

PRODUCTION OF ZINC

(In Tons of 2000 Lb.)

By Ore Smelters (a)

States	1911	1912	1913	1914
Colorado	7,477	8,860	8,637	7,792
Illinois	88,681	94,902	111,551	130,788
Missouri and Kansas	106,173	111,761	85,157	53,087
Oklahoma	46,333	76,837	83,230	91,593
East	47,172	56,278	69,687	77,429
Totals	295,836	348,638	358,262	360,689

(a) Includes some works that smelt dross and scrap as well as ore, but does not include works that smelt dross and scrap only. Discrepancies among statistical reports of the spelter production of the United States arise largely on account of the difference in the dividing line that is drawn in this respect.

At the beginning of 1914 the smelters of the United States had about 40,000 tons of unsold stock, while the International Convention in Europe had about 52,000 tons of 2000 lb. At the mid-year the stock in the United States had increased to 64,000 tons, and in Europe to 100,000 tons, most of the European stock being held in Germany. The inability of Great Britain to obtain its usual supply of spelter from Germany, together with the relative smallness of the stock held in England, compelled English consumers to turn to the United States for their supply, which developed an unparalleled export business in this country and averted the disaster that was threatening the American zinc industry previous to the war.

The course of prices is related in a subsequent article and need not be repeated here. A study of the market conditions, together with the production statistics, compels us to revise our previously held opinions that an average price of less than 5c. per lb. would be restrictive of ore supply in this country. Without any doubt 1914 was a bad year for the zinc smelters. The survivors of the old-time coal smelters were generally compelled to suspend smelting. The old plant at Nevada, Mo., was scrapped. Certain of the plants in the Kansas gas field were shut down. The new East St. Louis plant of the Granby company was completed but was not put in operation. The only new plants to go in operation in 1914 were the Sand Springs works of the Tulsa Spelter Co. and the Langeloth works of the American Zinc & Chemical Co., the latter going into operation too late in the year to cut any figure in the production. With the exceptions noted most of the smelters operated pretty nearly at full tilt.

It is manifest that a price of less than 5c. is not restrictive of ore supply, inasmuch as we witnessed in 1914 an increased production in spite of the absence of the former large Mexican supply. The fact is that Butte, Mont., has created an enormous addition to the domestic zinc-ore supply, and the flotation process that has been so successful there is finding important employment in other districts. The production of floated blende concentrates in 1914 was nearly 100,000 tons. In this connection let it be noted that the mills employing the flotation process produce a large proportion of jig and table concentrates, as well as the floated froth.

WORLD'S CONSUMPTION OF SPELTER

(Metric Tons)

(From statistical report of the Metallgesellschaft, Frankfurt am Main)

	1911	1912	1913
United States	251,600	312,900	313,300
Germany	219,300	225,800	232,000
Great Britain	175,700	185,200	194,600
France	82,000	82,000	81,100
Belgium	73,700	77,200	76,400
Austria-Hungary	43,500	46,800	40,400
Russia	28,900	27,900	33,300
Italy	10,100	10,700	10,900
Spain	4,800	4,700	5,900
Holland (estimated)	4,000	4,000	4,000
Other countries (estimated)	17,800	19,700	20,900
Total	911,400	996,900	1,012,700

WORLD'S PRODUCTION OF SPELTER

(Metric Tons)

(From statistical report of the Metallgesellschaft, Frankfurt am Main)

Germany	1911	1912	1913
Rheinland—Westphalia	81,458	86,619	92,852
Silesia	156,174	169,088	170,119
Other districts	12,761	15,357	20,142
Belgium	195,092	200.198	197,703
Holland	22,733	23,932	24,323
Great Britain	66,956	57,231	59,146
France and Spain	64,221	72,161	71,023
Austria and Italy	16,876	19,604	21,707
Russia	9,936	8,763	7,610
Norway	6,680	8,128	9,287
Sweden	.....	.....	.....
Europe	632,887	661,081	673,912
United States	267,472	314,512	320,283
Australia	1,727	2,296	3,724
Total	902,100	977.900	997,900

Of the American zinc smelters, Chanute, Collinsville (Illinois), Pittsburgh, Dearing and Nevada were idle throughout 1914. Caney and Altoona were operated during only a part of the year. The Tulsa Spelter Co. began operations in September. Pueblo, Palmerton, Bartlesville, Clarksburg and Meadowbrook made zinc dust.

The war cut off the exportation of New Jersey willemite, and from all parts of the world there was a keen demand for American high-grade, intermediate and brass special spelters, high-grade realizing 10c. per lb. and upward. There was also a sharp demand for American sheet zinc, of which our rolling capacity is relatively small,

probably not more than 35,000 tons per annum. Previous to Aug. 1 even that small capacity was only partially in use, but the European demand swiftly changed that condition and before the end of August the two manufacturers withdrew their regular price lists and subsequently quoted only in a private way. In the early part of 1914 there were some importations of sheet zinc from Germany, which alarmed Lasalle and Peru very much, but the war demand removed that fear. On the other hand, America's chief supply of zinc dust was cut off and the price of that article rose from about 6c. per lb. to 15 or 16c., but several additional American smelters engaged in the manufacture of it and the price declined to about 9 to 10c. per pound.

The International Zinc Convention presumably exploded with the declaration of war. This was a more or less loose organization, the essential feature of which was the agreement among three groups of smelters to curtail production in certain circumstances. The Belgo-German group itself was a hard and fast pooling of issues, the selling of the product being done under definite auspices. This union continued to exist after the outbreak of the war, but late in the year there were reports of internal friction.

ZINC SMELTING CAPACITY OF THE UNITED STATES

(Number of Retorts at End of Years)

Name	Situation	1913	1914
Altoona Zinc Smelting Co	Altoona, Kan.	3,300	(b) 3,840
American Zinc & Chem. Co	Langeloth, Penn.	.....	864
American Zinc Co. of Ill	Hillsboro, Ill.	3,200	4,000
American Zinc, Lead & Smg. Co	Dearing, Kan.	3,840	(a) 3,840
American Zinc, Lead & Smg. Co	Caney, Kan.	3,648	(b) 3,648
Bartlesville Zinc Co	Bartlesville, Okla.	5,184	5,184
Bartlesville Zinc Co	Collinsville, Okla.	8,064	8,064
Chanute Zinc Co	Chanute, Kan.	(b) 1,280	(a) 1,280
Clarksburg Zinc Co	Clarksburg, W. Va.	2,712	(d) 2,712
Collinsville Zinc Co	Collinsville, Ill.	(b) 1,536	(a) 1,536
Edgar Zinc Co	St. Louis, Mo.	2,000	1,100
Edgar Zinc Co	Cherryvale, Kan.	4,800	4,800
Granby Mining & Smg. Co	Neodesha, Kan.	3,760	3,840
Granby Mining & Smg. Co	E. St. Louis, Ill.		3,240
Grasselli Chemical Co	Clarksburg, W. Va.	12,672	5,760
Grasselli Chemical Co	Meadowbrook, W. Va.		6,912
Hegeler Zinc Co	Danville, Ill.	1,800	(d) 1,800
Illinois Zinc Co	Peru, Ill.	4,640	(d) 4,640
La Harpe Spelter Co	La Harpe, Kan.	1,856	(d) 1,856
Robert Lanyon Zinc & Acid Co	Hillsboro, Ill.	1,600	1,840
Lanyon-Starr Sm. Co	Bartlesville, Okla.	3,456	3,456
Matthiessen & Hegeler Zinc Co	La Salle, Ill.	5,256	5,256
Mineral Point Zinc Co	Depue, Ill.	6,800	9,080
National Zinc Co	Bartlesville, Okla.	4,480	4,260
National Zinc Co	Springfield, Ill.	3,200	3,200
Nevada Zinc Co	Nevada, Mo.	(a) 648	(c)
New Jersey Zinc Co	Palmerton, Penn.	5,760	5,760
Pittsburg Zinc Co	Pittsburg, Kan.	(b) 910	(a) 910
Prime Western Spelter Co	Gas City, Kan.	4,768	4,768
Sandoval Zinc Co	Sandoval, Ill.	896	896
Tulsa Fuel & Manufacturing Co	Collinsville, Okla.	6,232	6,232
Tulsa Spelter Co	Sand Springs, Okla.	.....	4,000
United States Zinc Co	Pueblo, Colo.	1,920	1,920
	Totals	110,218	120,494

(a) Inactive throughout year. (b) Inactive during latter part of year. (c) Plant being dismantled. (d) No report received; entered the same as last year.

According to the latest advices, the zinc smelters along the Meuse in Belgium are idle, but the plants in the Campine district are operating on a reduced scale. In Germany the Rhenish, Westphalian and Silesian works are understood to be operating on a reduced scale.

The zinc industry of the world is undergoing revolutionary changes whereof the full effects cannot yet be clearly perceived. The Zinc Corporation contracted its ore to German interests up to 1919. This company united with other Broken Hill producers and with the American Smelting & Refining Co. to build new smelting works either in Wales or in the United States, it being assumed that the war had terminated the German contracts. The German interests in the latter protested, however, and, pending the termination of the question as to whether these contracts were automatically terminated by the war or merely suspended, the plans have been delayed, but it is certain that sooner or later the Zinc Corporation will begin smelting on its own account.

In the meanwhile the same interests directing the Zinc Corporation are developing enormous ore deposits—the Bawdwin mine in Burma and the Ridder mine in Siberia—for each of which smelting works will be erected. In fact, the plant for the Ridder mine is already in course of construction.

The Russo-Asiatic Corporation has developed about 2,000,000 tons of ore in the Ridder mine in the Altai Mountains, Siberia, about 1,000,000 tons being solid sulphide ore, assaying about 27% zinc, 18% lead and 1 oz. gold per ton; and 1,000,000 disseminated ore assaying 8 to 9% zinc and 4 to 5% lead. This mine, together with a coal mine at Ekibastus, were lately transferred to the Irtysh Corporation as an operating concern. That company is going to build a zinc-smelting works at Ekibastus, about 50 miles west of Semipalatinsk, on the Irtysh River. The ore will be taken by railway from the mine to the river, then floated about 7000 versts down the river and then taken by rail to the coal field. The spelter and lead will go by rail to the river and then down the river to the Omsk, on the Trans-Siberian railway. A zinc smeltery of 140 tons capacity and a lead smeltery of 40 to 50 tons are planned. Grading has already been begun. The European war is not interfering with mining and industrial operations in Siberia, but inability to obtain machinery from Germany is troublesome in new construction.

It is evident, therefore, that Russia is soon going to become a large producer of spelter, and will make an output far in excess of that of the two works in Poland, which are in a district occupied by the Germans since the early days of the war.

At the same time the zinc-smelting industry in Japan is undergoing an important development. The Amagasaki works have been brought to a capacity for producing about 3000 tons of spelter per annum, and further expansion is contemplated. Japan will doubtless supply all of her own spelter in the not very distant future.

All these things are going to add greatly to the zinc supplies of the world. During the time of the war we shall see disturbances of the usual channels of commerce, acting favorably upon the interests of one country and *vice versa* in another country, but nothing is happening to check the original supply, and as soon as the war terminates the means for smelting may become immediately available again.

The Spelter Market in 1914

At the beginning of 1914 spelter stood at 5.10c., St. Louis, and the market was under the cloud of the 40,000 tons of unsold stock reported at the end of 1913, a larger quantity than ever before recorded in the history of this industry in the United States. In Europe also there was a large unsold stock, the International Convention being estimated to have about 52,000 tons of 2000 pounds.

AVERAGE PRICE OF ZINC SHEETS

(In Cents per Lb.)

	1913	1914		1913	1914		1913	1914
January	9.00	7.44	May	7.63	7.00	September	8.00	8.50
February	8.63	7.25	June	7.25	7.00	October	7.63	8.07
March	8.20	7.10	July	7.13	7.00	November	7.50	8.00
April	7.88	7.00	August	7.90	7.38	December	7.25	8.55

Average for the year 1913—7.833; year 1914—7.524 cents.

Note:—These are base prices for ordinary size sheets, in carload lots, f.o.b. Lasalle-Peru, Ill., less 8% discount.

For three months the spelter market was dull and uninteresting, the price fluctuating between 5c. and 5¼c., but generally standing at 5.10 to 5⅛c. In April more emphatic pressure to sell was exhibited, and the price fell to 4⅞c. The producers were lugging uncomfortable loads, stocks being on the increase rather than on the decrease, yet everybody was reluctant to cut prices, it being figured that all of the unsold spelter had actually cost more than 5c. per lb. The situation was bad in Europe also, where ever since the beginning of the year the unsold stock in the hands of the convention had been increasing, and at the end of April was estimated to amount to about 90,000 short tons, a larger quantity than was reported at any time in 1913. Effective May 1, the convention ordered a curtailment of output at the rate of about 18%.

MONTHLY AVERAGE PRICE OF SPELTER

	New York			St. Louis			London		
Month	1912	1913	1914	1912	1913	1914	1912	1913	1914
Jan.....	6.442	6.931	5.262	6.292	6.854	5.112	26.642	26.114	21.533
Feb.....	6.499	6.239	5.377	6.349	6.089	5.228	26.661	25.338	21.413
Mar.....	6.626	6.078	5.250	6.476	5.926	5.100	26.048	24.605	21.460
Apr.....	6.633	5.641	5.113	6.483	5.491	4.963	25.644	25.313	21.569
May.....	6.679	5.406	5.074	6.529	5.256	4.924	25.790	24.583	21.393
June.....	6.877	5.124	5.000	6.727	4.974	4.850	25.763	22.143	21.345
July.....	7.116	5.278	4.920	6.966	5.128	4.770	26.174	20.592	21.568
Aug.....	7.028	5.658	5.568	6.878	5.508	5.418	26.443	20.706	†
Sept.....	7.454	5.694	5.380	7.313	5.544	5.230	27.048	21.148	†
Oct.....	7.426	5.340	4.909	7.276	5.188	4.750	27.543	20.614	†
Nov.....	7.371	5.229	5.112	7.221	5.083	4.962	26.804	20.581	25.016
Dec.....	7.162	5.154	5.592	7.081	5.004	5.430	26.494	21.214	27.369
Year...	6.943	5.648	5.213	6.799	5.504	5.061	26.421	22.746	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.
† Not reported.

Conditions in the United States remained without material change until July, when the market became distinctly weaker. It was realized by everybody that the unsold stock had increased over the figures of Jan. 1, but few persons supposed that it amounted to any more than 50,000 tons. When, therefore, the official statistics showed the existence of 64,000 tons at the mid-year, the trade experienced a disagreeable surprise. This resulted in pronounced selling pressure, and the market declined to 4¾c. At this time, the spelter-producing industry was steeped in profound pessimism. There was a sincere expectation that the price for spelter would go down to 4c. per lb. In fact, some large blocks were tentatively offered to the principal consumer at a very low price, but when it appeared that those offers might be accepted, the producers promptly withdrew them and took courage again. This was only a few days before the outbreak of the war. Domestic consumers, learning that they were not going to find spelter on the bargain counter right away, made some purchases, and there was a rally in the price to about 4⅞c.

Immediately following the outbreak of the war, a large business was done at steadily advancing prices, the governing condition being the anticipation that England would shortly have to buy large quantities of American spelter, owing to the loss of her usual supply from Belgium and Germany. The stock of spelter held by the International Convention was estimated to amount to 100,000 short tons at the mid-year, but this was chiefly held on the Continent and especially in Germany, wherefore Great Britain was rendered nearly destitute.

About the middle of August the expected sales of American spelter for export began, and then followed one of the most foolishly crazy movements in spelter that we have ever seen. On Aug. 25 one producer sold spelter for export at 6.10c., St. Louis, but at the same time it was willing to let domestic consumers have all they wanted at 5⅞c. American consumers, however, were at no time active buyers on this wild upward movement. We made sales in August to England, Russia, Japan, South Africa, and other countries ordinarily unusual in our trade. High-grade, intermediate, and brass special spelters were especially in demand and realized fancy prices. The sheet-zinc rollers, whose business had been dull for many months, immediately experienced a demand taxing their capacity to the utmost, and on Aug. 20 they withdrew their open quotations and thereafter made sales only on private terms.

The foreign demand culminated about the end of August, and then petered out with amazing rapidity. It appeared that England had temporarily overbought herself and that speculation had played a very unhealthful part in the recent movement. A little later it turned out that England was able to obtain some supplies of spelter from Rotterdam, which became available at about 5⅛c., a figure below our parity, and cutting us off from immediate possibility of selling any more spelter for export.

The decline in the price for spelter was about as rapid as the August rise had been. In the early part of October our market was at 4¾c. and spelter was not easily salable even at that price. Pessimism again reigned everywhere. Then came the news that the Butte & Superior, the largest producer of ore, was going to shut down for several months to make repairs, and immediately there was a small recovery in the market. During November the price hung around 4⅞ to 5c. A renewal of the demand from abroad had been experienced, but this time the business was done in a sensible and orderly way. American consumers were right along conspicuous by their absence, but in December a further expansion of the demand for export carried the price up to about 5½c. It was the common opinion in December that the statistics at the end of the year would show a noteworthy decrease in the unsold accumulation, as compared not only with the mid-year, but also as compared with the beginning of the year.

The Joplin District in 1914

By Jesse A. Zook*

As indicated in the review of 1913 sheet-ground mines were gradually abandoned, weeding out all but the best. The extreme low level of prices during May, June, July and early August extended over a period of too great length for the thinner ones to withstand.

Three areas increased production, Alba-Neck in Missouri, Lawton in Kansas, and Miami-Commerce in Oklahoma. The two former are known as "free-ore" deposits. The latter is largely a free horizontal vein, with dips, chimneys and pockets equaling free-ore deposits.

*Joplin, Mo.

Variations in Prices

The range in high prices of blende was: January opened $45, closed $44; February opened $45, closed $46; March opened $43.50, closed $43; April and May saw nothing

over $43; but June closed $44; July opened $42, closed $41.50; August opened $42.50, closed $53; September opened $50, closed $44; October opened $45, closed $49; November declined to $47, rising to close $48.50; weekly

JOPLIN DISTRICT ORE SHIPMENTS, IN POUNDS*

Missouri	Blende	Calamine	Lead	Values
Jasper County	375,804,640	1,807,100	60,383,410	$1,412,450
Newton County	25,263,270	33,439,290	4,860,770	955,110
Lawrence County	391,500	4,062,770	250,740	64,050
Other counties	679,000	116,000	.....	15,570
Total	402,138,410	39,425,170	65,494,920	$10,153,790
Oklahoma				
Ottawa County	63,430,820	.....	16,898,880	1,566,950
Kansas				
Cherokee County	43,506,660	.....	4,860,200	1,001,470
Total 1914 (*)	509,075,490	39,425,170	87,254,000	12,722,210
Total 1913	554,162,910	43,383,770	95,779,640	15,272,330
Decrease	45,155,420	3,958,600	8,525,640	2,550,120

(*) December estimated for each county.

increases during December brought the year to a close with blende very strong around $50 to $52—$5 to $7 per ton higher than the year's opening.

January, February and March brought a comparatively even high price level of $51.50 to $54; April opened $53, closed $47; May, June, July, August and September price level was between $47 and $48.50; October opened $48, closed $42; November opened $43.50, closed $49; A lower pig-lead market came with December, but galena was not changed in price.

All the developed mines in the Carthage area were abandoned in October, and low prices retarded prospecting for new ore reserves. Sarcoxie had an intermittent career, declining until July when a revival came with developments that forecast a widening of the developed area and an increased production. Carl Junction dwindled from 750 tons per month in January to 100 tons at the year-end. Oronogo shipments weakened in September but came out stronger at the close than the beginning of the year. Wentworth skipped shipments in June, July and August, coming back in September. Aurora operations are on upper levels and the production principally calamine, with some blende and galena. Quapaw, once promising, is a small factor now from lack of systematic development.

ORE PRICES IN JOPLIN DISTRICT

(14 Years)

Year	Zinc Ore High	Zinc Ore Aver.	Lead Ore High	Lead Ore Aver.
1901	$34.00	$24.21	$47.50	$45.99
1902	42.00	30.33	50.00	46.10
1903	42.00	33.72	60.50	54.12
1904	53.00	35.92	62.00	54.80
1905	60.00	44.88	80.00	62.12
1906	54.00	43.30	87.00	77.78
1907	53.50	43.68	88.50	68.90
1908	47.00	34.36	66.00	54.66
1909	55.00	41.08	60.50	54.56
1910	52.00	40.42	58.00	51.98
1911	51.00	39.90	64.00	56.76
1912	67.00	52.15	68.00	56.60
1913	53.16	42.62	57.78	52.82
1914	50.50	39.43	50.88	46.55

The closing of some large mills, with the men out of employment, resulted in the unemployed seeking shallow abandoned workings, a factor preventing a greater decrease in the production. Blende-galena revivals in shallow workings extend from Lone Elm hollow across Possum hollow, Chitwood hollow, Leadville hollow, East and West hollows to Zincite, all to the northwest of Joplin. Southeast of Joplin came a growth in calamine production from shallow workings in the north edge of Newton County. Across Shoal Creek, farther south, old workings were revived and new mines developed with a mixed output of calamine and galena.

Miami-Commerce

With the establishment of a townsite and the rapid building of the town of Commerce, five miles north of Miami, the old mining camp of Hattenville was absorbed in the upspringing of the incorporated town. New developments of this area are mainly to the north of Commerce. A drilling campaign progressed throughout the year, closing with 30 outfits in operation. One mill is in operation and another building three miles northeast of Commerce, on shaft development that predicates an even greater orebody than the older mines.

The Picher Lead Co., of Joplin, holds leases on 2700 acres of land north of Commerce to the Kansas State line, on which nine drilling outfits are continuously at work. While exact records are not at hand current report is that a wide range of the zinc-lead deposit was encountered, carrying 16% blende and 7% galena.

Zinc Mining in Wisconsin in 1914

By J. E. Kennedy*

The net tonnage of zinc ore shipped to smelteries from the Wisconsin district in the first 11 months of 1914 was 152,186,990 lb., an increase of 15,831,680 lb. over the figures given for the corresponding period of last year. The gross tonnage of zinc ore produced and shipped by mining companies to smelteries and to custom roasters was 239,073,920 lb., an increase of 46,719,690 lb. The tonnage of lead ore shipped was 4,838,890 lb., a decrease of 284,190 lb. while the shipments of sulphur ore, 30,664,650 lb., decreased 22,370,260 lb.

The price of zinc ore was uniformly low throughout the greater part of the year. The average base price paid for 60% zinc ore in the first 11 months was $41 per ton; the high base was $47 and the low base was $37 per ton. The market was on the up turn in December.

A total of 46 mills and 5 roasters were in operation at various times during the year. Eight new and reassembled mills were added, viz., the Champion and Penna-Benton at Benton, the Kistler and West Hill at Platteville, the Coker No. 2 and Biddick at Mifflin, the Lawrence Hazel Green and the North Unity at Galena. The Kittoe at Benton, and the Thompson at New Diggings were in course of construction at the year-end by the Vinegar Hill and Field Mining companies. The Champion mill can handle 400 tons of dirt in 10 hr.; the Thompson will concentrate 250 tons in 10 hr. The larger operating companies continued prospect and development work throughout the year and opened up several good properties particularly in the Benton-New Diggings camp. Surveys have been made for an electric railway to run from Lancaster southeast through the mining district to Warren, Ill., and continuing via Stockton to Chicago, Ill.

The Wisconsin state legislature of 1913 passed a law assessing mineral lands for taxation upon the computed value of "ore in the ground." W. L. Uglow, representing the state tax commission, made an investigation and report upon the value of mineral lands of this district lying within the state.[1] In the case of operating mines he based his estimate of value upon production, profits

*Platteville, Wis.

and drill-hole records as revealed by operators. In the case of undeveloped properties he relied upon drill-hole records obtained second-hand from operators and land owners. The tax commission submitted Mr. Uglow's table of valuations in Benton Township to the local board of review in May, 1914. After discussion of the subject, an adjournment was taken to allow the tax commission to reduce its estimates, at the same time eliminating the figures placed upon undeveloped properties based upon their mineral value. In the final analysis, assessments were made by the supervisors based upon general knowledge

SHIPMENTS OF WISCONSIN ZINC ORES IN 1914

(First 11 Months)

	Net to Smelteries		Gross from Mines	
	1913	1914	1913	1914
Highland	2,613,020	5,097,650	2,613,020	5,097,650
Linden	4,701,520	7,570,190	17,207,210	11,612,280
Harker	2,565,230	6,855,120	5,807,170	11,316,200
Mineral Point	31,268,750	36,996,820	2,223,650	1,095,480
Dodgeville	227,100	1,254,290	407,100	1,516,270
Montfort	1,272,000	1,906,000	2,301,980	1,906,000
Livingston	.....	.....	22,730,460	29,427,020
Rewey	1,374,740	.....	1,445,740	.....
Platteville	23,075,270	12,781,940	23,319,110	5,287,560
Cuba City	12,762,280	19,640,100	6,331,830	5,370,430
Benton	24,538,590	31,740,910	41,451,090	69,563,720
Hazel Green	14,202,000	14,222,200	29,186,440	31,625,100
Shullsburg	14,086,410	2,096,070	17,025,810	19,209,800
Potosi	244,000	.....	244,000	.....
Galena	3,424,400	12,025,700	20,059,620	46,046,410
Totals	136,355,310	152,186,990	192,354,230	239,073,920

(Shipment from the Crahall mine at Scales Mound is credited to Benton.)

of production and profits. No disparagement is made of the work of Mr. Uglow. The tax commission has practically conceded that the system proposed cannot be scientifically or practically applied to conditions obtaining in this district and there is little doubt but that the law will be repealed or materially revised at the coming session of the state legislature. There is now in effect in Wisconsin a state income-tax law which taxes both the operator and the land owner on profits derived. If the law is inadequate it should be amended and a rate established that would tax the mining industry as a whole proportionately to the other industries of the state. To increase the land tax of a mining property by placing thereon an assumed and arbitrary assessment based upon a future and fictitious value is unjust, unsound and discriminatory. If such a system is applied to zinc mines why not include rock quarries, gravel pits, clay deposits, peat, etc., all of which are in the mineral class.

The Wisconsin liability and compensation law which was looked upon with ill favor when first enacted is working out satisfactorily to both operators and miners. Two amendments, however, are desired by operators; (1) Foreign dependents should receive no more as compensation for the death of a relative killed here than a foreigner would receive under like conditions in the particular country involved, at least no more than such dependents would receive if their relative were killed at home; (2) the burden of proof should be placed upon the foreign claimants to prove dependency.

Zinc in Oklahoma in 1914

By R. J. Tuthill*

The principal zinc mines in Oklahoma are all located in Ottawa County and the Miami is the only active camp at present, although some mining is being done at the Lincolnville and Peoria camps.

The first part of 1914 witnessed lower ore prices than for several years and was the cause of extensive curtailment of production, but since the rise in the price of spelter in August the operators have been able materially to increase their earnings and have also increased the production.

When mining first started in the Miami camp, the grades of zinc ores were low and the ore carried considerable iron pyrites, which reduced the value considerably. This year has witnessed the production of ore grading as high as 63% with less than 1% iron pyrites, and several of the producing mines have raised their grades to an average of about 60% zinc.

None of the ore contracts that were made and in force in 1913 were renewed in 1914, and with few exceptions all the mines are now selling on the open market. A good many sales are made on what is called a "metal base," as follows: No penalty or deduction for iron and $1 off the base price for each point the grade is below 60% Zn.

During the year a great amount of prospecting by drilling has been done, especially on the northeast of the present camp, with satisfactory results. The Picher Lead Co. and the Commerce Mining & Royalty Co. have led in this work and at the present time five different shafts are being put down to the orebodies that have been proved. In this same vicinity the Cornfield Mining Co. has just completed a modern mill which will be in operation the latter part of December and will materially increase the production of the camp. The Zinc Issues Co. has also done some drilling and has developed the fact that there is a run at 380 ft. depth. This means that the life of the present mines will be continued for an indefinite time.

While there has not been the amount of exploration on the southwest of the present main camp as on the northeast, still the work done has proven some very rich runs of ore, both lead and zinc. The zinc from this part of the camp is all grading better than 61%.

Another feature of interest during the year is the opening up of an orebody directly below the old upper run in the Newstate and King Jack mines. This orebody is very rich, as the average recovery of concentrates is over 10%.

The report of the production from the Miami camp shows an increase over 1913, as will be seen from a comparison of the following statements:

PRODUCTION FOR 1913*

	Lb.	Value
Blende	46,914,325	$755,152.15
Lead	14,773,400	403,650.98
Total		$1,158,803.13

PRODUCTION FOR 1914*

December Estimated

	Lb.	Value
Blende	63,591,145	$1,115,266.08
Lead	20,339,834	501,296.88
Total		$1,616,562.96

*The above does not include shipments from Lincolnville and Peoria camps.

Tin

Tin production in the United States showed no change in 1914, being limited to a few tons of concentrates, so far as primary output is concerned. The secondary production amounts to about 6000 tons of metal recovered from scrap; this is largely used in making tin salts and for chemical purposes.

As usual, the figures for production and consumption are based chiefly on the market reports of shipments and

[1] "Eng. and Min. Journ.," Nov. 28, 1914.

*Miami, Okla.

deliveries. Most of the production, about 75%, is included in what are known in the trade as "The Statistics," in which shipments and deliveries are carefully and closely recorded. The estimated production outside of this is accepted as going directly into consumption. According to the figures given, the production in 1914 decreased by about 4000 tons, and the consumption by 4540 tons. The excess of production over deliveries in 1914 was 950 tons only.

The war, while it did not touch any producing country directly, did interfere considerably with the transportation and delivery of the metal. In a large proportion of the European Continent the deliveries were cut off, while shipments from the East were delayed, and in one case a loss was caused of 700 tons on board of a British vessel, sunk by a German cruiser. The most serious trouble has been in the case of Bolivian tin, which has been nearly all shipped to Europe in the form of concentrates, from 60 to 70% going to Germany to be smelted and refined The German works are unable now to take this, and a new outlet is being sought. Negotiations have been in progress for the erection of smelting works in the United States. but so far no definite conclusion has been reached.

While there are few changes in the uses to which tin is applied, there is in normal years an increase of about 5% in the consumption, with the growth of population and industry. The larger part of the growth is in the use of tinplate for containers of oil, vegetables and other preserved provisions. While the war on the one hand should mean an increased consumption of tinplate for such purposes, on the other it interferes with the distribution, so that it is hard to say whether the demand for tin is increased or not.

WORLD'S PRODUCTION OF TIN

(Metric Tons)

(From statistical report of the Metallgesellschaft, Frankfurt am Main)

	1911	1912	1913
Straits Settlements	57,944	61,528	65,640
Great Britain:			
From home ores	4,950	5,338	*c* 5,300
From other ores *a*	13,850	13,600	16,700
Germany *a*	11,378	11,000	*c* 11,500
France	500	500	1,200
Banca (sold in Holland)	15,147	16,111	15,173
Billiton (sold in Holland and Java)	2,240	2,243	2,243
Australia	5,150	5,130	4,870
China (exports)	6,050	8,782	*c* 6,000
Bolivia *b*	400	500	300
	117,600	124,700	128,900

a Mainly from Bolivian ores. *b* Importation of Bolivian crude tin into Great Britain. *c* Estimated.

WORLD'S CONSUMPTION OF TIN

(Metric Tons)

(From statistical report of the Metallgesellschaft, Frankfurt am Main)

	1911	1912	1913
Great Britain	21,900	21,800	24,400
Germany	18,300	20,200	19,300
France	7,400	7,500	8,300
Austria-Hungary	4,000	3,800	3,200
Belgium	1,700	1,500	2,300
Russia	1,900	2,600	2,700
Italy	2,400	2,500	2,900
Switzerland	1,200	1,400	1,400
Spain	1,200	1,300	1,300
Scandinavia	1,400	1,500	1,600
Holland	*a* 250	*a* 250	*a* 250
Other European countries	1,200	1,100	1,200
Total Europe	62,800	65,500	68,900
United States	48,000	51,700	45,000
Other America	2,300	3,300	3,400
Australia	*a* 900	*a* 1,200	*a* 1,400
Africa	*a* 500	*a* 600	*a* 500
China (imports)	1,993	2,427	*a* 2,400
Other Asia	3,000	3,000	3,300
World's consumption	119,500	127,700	124,900
World's production	117,600	124,700	128,900

a Estimated.

TIN PRODUCTION AND CONSUMPTION

(In Long Tons)

	1913	1914
Exports, Straits and Malay Peninsula	62,242	61,986
Exports, Australian	3,253	1,771
Banka and Billiton sales	17,142	10,975
Chinese exports and production*	8,200	8,255
Bolivian exports*	22,719	24,844
South African production*	1,900	2,276
Nigerian production*	.....	1,962
Cornwall production*	4,900	4,500
Total	120,356	116,569
U. S. imports and consumption	45,900	42,995
Great Britain, imports and consumption	28,736	30,531
Holland, imports	16,573	15,810
Other Europe, imports	21,250	18,633
Australian consumption	1,000	1,050
China and India consumption	6,500	6,400
Totals	119,959	115,419
Visible stocks, Dec. 1	16,045	13,432

*Not in "Statistics."

Monthly Lead and Ore Prices

The accompanying table gives the average prices of lead and zinc ore as determined from actual transactions in the field, and reported by the JOURNAL'S correspondents.

AVERAGE MONTHLY ORE PRICES

	Zinc Ore						Lead Ore			
	Joplin base		Joplin all ores		Platteville		Joplin		Platteville	
	1913	1914	1913	1914	1913	1914	1913	1914	1913	1914
	$	$	$	$	$	$	$	$	$	$
Jan.	53.30	40.63	52.22	38.71	53.10	50.09	52.55	50.09	51.00	51.38
Feb.	46.88	42.50	44.34	41.15	46.63	42.63	52.66	50.76	52.38	51.50
Mar.	46.50	38.88	44.62	38.54	46.38	40.13	53.22	50.00	52.50	49.90
April.	42.50	38.55	40.92	36.75	42.20	39.25	52.71	45.71	52.70	47.40
May.	43.69	39.31	41.76	36.68	42.25	39.25	51.84	46.62	52.63	48.00
June.	41.75	39.63	40.30	38.41	42.19	39.75	52.22	46.40	52.50	48.00
July.	43.55	38.95	40.88	35.58	43.35	39.20	52.39	45.76	52.50	46.70
Aug.	47.06	43.75	44.54	41.02	46.13	44.00	55.79	45.75	55.25	45.00
Sept.	46.13	43.10	44.30	41.33	46.75	43.80	56.59	45.70	58.00	44.50
Oct.	42.10	40.38	40.07	38.46	42.20	40.50	52.94	40.84	54.60	41.50
Nov.	41.81	43.13	39.99	41.63	41.50	44.00	51.49	43.99	52.75	45.50
Dec.	39.19	48.25	37.50	44.95	38.50	47.75	49.46	46.93	48.00	45.62
Year.	44.54	41.42	42.62	39.43	44.26	42.53	52.82	46.55	52.90	48.75

Joplin base and Platteville zinc prices are on standard ores, 60% zinc. Second Joplin price is average for all zinc ores sold.

The Tin Market

At the beginning of 1913 the price of tin in New York was about 50c. per lb., and it had begun to look as if even a higher price might be realized, owing to shortage in the supplies, but contraction in consumption more than offset any shortage, and the general tendency throughout 1913 was declining, the price at the end of that year being about 37½ cents.

MONTHLY AVERAGE PRICES OF TIN IN 1912, 1913 AND 1914

Month	New York			London		
	1912	1913	1914	1912	1913	1914
January	42.529	50.298	37.779	191.510	238.273	171.905
February	42.962	48.766	39.830	195.036	220.140	181.556
March	42.577	46.832	38.038	192.619	213.615	173.619
April	43.923	49.115	36.154	200.513	224.159	163.963
May	46.053	49.038	33.360	208.830	224.143	150.702
June	45.815	44.820	30.577	205.863	207.208	138.321
July	44.519	40.260	31.707	202.446	183.511	142.517
August	45.857	41.582	*	208.351	188.731	*
September	49.135	42.410	32.675	223.762	193.074	*
October	50.077	40.462	30.284	228.353	184.837	*
November	49.891	39.810	33.304	227.619	180.869	139.391
December	49.815	37.635	33.601	226.875	171.786	147.102
Av. year	46.096	44.252		209.322	206.279	

New York in cents per pound; London in pounds sterling per long ton. * No quotations.

In 1914 the general tendency of tin was also declining, although in January and February there was a small rally in common with what was experienced by the other metals. However, by the mid-year tin was down to about 30c. per lb. The outbreak of the war caused a tremendous scare about tin supplies, all of which come by sea and were thought likely to be cut off entirely. The price rose to fancy prices for the small quantity of tin actually in stock in New York, 75c. per lb., even, being realized. This represented, however, what was merely picayune business—1-

tons to 5-ton lots—and was in no wise representative of a broad commodity price.

During August there was no wholesale market, for the simple reason that there was no wholesale supply. By the end of that month supplies began to come in, and the fancy prices immediately disappeared. In September tin was down to the basis of about 32½c. per lb., and in October it was about 30¼c. In November and December it was a few points higher. The position of tin seems to be that the high prices of two years ago stimulated production, while consumption has diminished along with the general contraction of business experienced in the United States in 1913 and 1914.

Quicksilver

The production of quicksilver in the United States in 1914 was about 16,300 flasks, compared with about 20,000 flasks in 1913. The production of California in 1914 was 11,279 flasks, compared with 15,600 flasks in 1913. The production outside of California is chiefly derived from Texas and Nevada, the Chisos mine, in the Terlingua district of Texas, the Mercury Mining Co., of Ione, Nev., and the Gold Banks mine, of Nevada, being important producers. Several other mines were operated on a small scale in Nevada and in Arizona.

WORLD'S PRODUCTION OF QUICKSILVER

(Metric Tons)

(From statistical report of the Metallgesellschaft, Frankfurt am Main)

United States:	1911	1912	1913
a. California *a*	578	701	578
b. Texas	116	154	136
c. Other states	37		
United States	731	855	714
Spain *b*	1,486	1,490	1,490
Austria-Hungary	793	783	855
Italy	931	986	988
Mexico (estimated)	150	150	150
Total	4,100	4,300	4,200

a "Eng. and Min. Journ." *b* Exports.

The principal producers in California were the New Idria, Oceanic, New Guadalupe and New Almaden, these being the only producers credited with more than 1000 flasks each.

There was a large importation of quicksilver into New York in 1914, and for some time during the fall the market was considerably disturbed by a large unsold stock of Italian quicksilver. Considerable supplies of Mexican quicksilver also were received here. The effect of these large introductions of quicksilver were to make New York a primary market instead of being merely a reflection of San Francisco.

AVERAGE MONTHLY PRICE OF QUICKSILVER

(Per Flask of 75 Lb.)

Month	New York	San Francisco Domestic Sales	San Francisco For Export	London
January	$38.75	$38.63	$36.63	£7.50
February	39.00	38.50	36.50	7.50
March	38.60	38.30	36.30	7.30
April	38.00	38.00	36.00	7.00
May	37.90	37.60	35.60	7.00
June	38.00	37.13	35.13	7.00
July	36.75	36.50	34.50	6.75
August	83.00	90.00	.....	.....
September	74.38	74.00	.....	.....
October	53.75	53.50	.....	.....
November	50.30	51.00	.....	.....
December	51.25	51.00	.....	.....
Year 1914	$48.31	$48.68	.....	.....
Year 1913	39.54	39.28	$36.81	£7.38
Year 1912	42.46	42.05	39.55	8.14
Year 1911	46.54	46.01	43.62	....
Year 1910	47.06	46.51	44.54	.....

Quicksilver was steady at about $36@39 up to August, which was a shade less than in 1913, although there was a rather remarkable contraction in the domestic production. Upon the outbreak of the war, the price advanced, and in a single week jumped from about $45 to $90@100. This seems to have been a foolish extravagance, based on the suspension of the quicksilver business in London and the theory that all the quicksilver of the world would be wanted for military purposes, it being employed in the manufacture of explosives. Instead of this being the case, the high price in this market attracted importations from Italy, a previously unheard of movement, while we also obtained some supplies from Mexico, and the price for quicksilver in New York declined rapidly to about $40 per flask, from which there was recovery to about $52.50.

Quicksilver in California in 1914

By Lewis H. Eddy

Quicksilver production in California in 1914 is estimated at 11,200 flasks of 75 lb., a decrease from 1913 of about 4400 flasks. Decline in production was due in some measure to low prices in the first half of the year and to the fact that the increase in price due to the effects of the European war came with a suddenness that did not permit of preparation for an increased production by the more important mines. In fact, some of the larger producers showed the greatest percentage of decrease. In the early part of the year prices went as low as $34 and $35 per flask, and the rise in the middle of August to $75 did not last long enough to be largely taken advantage of. There were some large shipments from the larger mines at the advanced prices; and some of the smaller producers sought to take advantage of what they believed would be a permanent price during the remainder of the year. But the price declined steadily to $55 and $52.50 in November. Decrease in production was no doubt due also to the lack of development of new orebodies. The producing counties in the southern part of the state were San Benito, San Luis Obispo, Monterey and Fresno. In the northern part of the state the chief production came from Santa Clara, Solano, Napa and Lake Counties. The New Idria decreased production by approximately 3000 flasks; the Oceanic increased by 200 or 300 flasks. There was a decrease in Santa Clara County, and Lake County made but small showing. The St. Johns mine in Solano County was reopened and made a creditable showing. The Alpine in San Benito County reopened and made a good start, but closed down after a short run. The Pacific in Fresno County, which was reopened and put on a producing basis in 1913, closed down in October, 1914. The Kings Quicksilver Mining Co. opened the Francis mine at Parkfield, Monterey County, installed a 10-ton Scott furnace and a concentrating plant and placed Monterey in the list of producing counties. The concentrating plant at the Oat Hill mine, installed in 1913 for working the waste dumps, was increased in capacity and improved in method of moving the material to the Standard tables. The Aetna mine in the same district also made some improvements in the concentrating plant, but early in the year was extracting high-grade ore and retorting it direct. It was reported that a concentrating plant was contemplated at the Cloverdale mine in Sonoma County. A small initial concentrat-

ing plant was installed at the Oceanic mine for the treatment of wet ores, but not with the purpose of substitution for furnace treatment of dry ores. Development at the New Idria contemplated driving lower tunnel levels. New Almaden production came from ores extracted by leasers. Company operations have not been resumed. With fair prices the production of the state in 1915 should be at least normal, as there is a disposition to advance quicksilver mining.

Petroleum in the United States in 1914

The petroleum industry experienced a remarkable advance in production in 1914, but the year was an unsatisfactory one for producers on account of the reduced prices obtained for their output. The production for 1914 was approximately 290,000,000 bbl., or about 40,000,000 bbl. greater than in 1913. The principal increases were in California, Oklahoma, Texas, Louisiana and Wyoming. most other fields having declined in production. California passed the 100,000,000-bbl. mark for the first

PRODUCTION OF CRUDE PETROLEUM IN THE UNITED STATES

(In Barrels of 42 Gal.)

Field	1912	1913	1914
California	84,823,992	96,881,967	100,093,568
Colorado	200,000	220,000	(*f*) 200,000
Texas (*a*)	11,778,324	15,544,046	20,586,377
Louisiana	9,791,896	12,901,703	16,860,235
Illinois	28,400,000	(*e*) 23,893,899	21,500,000
Lima { Indiana	1,200,000	4,750,000	2,900,000
Lima { Ohio	3,000,000		
Mid-continental (*b*)	52,771,603	64,556,000	(*d*) 97,400,000
Kentucky-Tennessee	500,000	500,000	580,000
Appalachian (*c*)	26,000,000	25,673,000	23,800,000
Wyoming	500,000	2,354,000	4,100,000
Others	5,000	50,000	(*f*) 50,000
Total	218,970,815	247,321,615	288,070,180

(*a*) Includes Panhandle field of Texas. (*b*) Kansas and Oklahoma, only. (*c*) Pennsylvania, New York, West Virginia and eastern Ohio. (*d*) Estimate of Dr. David T. Day, in "Oil, Paint and Drug Reporter", Jan. 2, 1915. (*e*) U. S. Geol. Survey. (*f*) Estimated.

time, this being brought about by the gushers in the Midway fields, the most noteworthy of which was that brought in by the Lakeview No. 2 Oil Co.; this produced approximately 3,000,000 bbl., after which the hole collapsed; the well was out of control during its life. In the Gulf field, the increased production was brought about by deep drilling in the Sour Lake pool and the opening of four new pools, De Soto and Edgerly in Louisiana, and the Moran and Orange pools in Texas; the output from the De Soto pool was over 5,000,000 bbl. The increased production in the Mid-Continental field was principally in Oklahoma, the Cushing and Healdton pools leading in the new production. The Royal Dutch-Shell company increased its holdings both in Oklahoma and in California. The General Petroleum Co. in California was unable to pay its bond interest and hence its plan for acquiring the Union Oil Co. was not consummated. Nearly 20,000,000 bbl. of fuel oil were imported from Mexico in 1914, the disturbed condition of that country not having interfered so seriously with the oil production near the coast, as with the metal mining conducted farther inland.

The developments of 1914 in the important oil fields will be treated in detail in a subsequent issue.

Cement

Business in cement was poor throughout 1914, owing to the contraction of building operations. Among the Lehigh Valley mills the price was steady at 95c. per bbl., in bulk, f.o.b. mill, but in the Western markets there were considerable fluctuations. At Chicago the price was $1.05 in January, $1.15 in March, $1.17 in August, $1.15 in September, and $1.10 in October. In May the mills of the country were estimated to be operating at 60% of capacity and in June at 50%.

After the outbreak of the war the cement manufacturers expected that South America, Asia and Africa would turn to the United States for the supplies that they had previously been obtaining from Belgium and Germany. Inquiries from those markets were, indeed, received, but no considerable business appears to have developed as yet, owing to difficulties about freight and exchange, which will probably be overcome sooner or later.

According to the United States Geological Survey, the production of portland cement in the United States in 1914 was approximately 88,514,000 bbl., compared with 92,097,131 bbl. in 1913. The estimated shipments of portland cement during 1914 were 86,715,000 bbl., compared with 88,689,377 bbl. in 1913. Stocks of cement at the mills increased from 11,220,328 bbl. in 1913 to 12,818,000 bbl. at the close of 1914.

The Lehigh district showed a decrease of more than 9% in both production and shipments. The Illinois and northwestern Indiana district showed a slight decrease, and the Pacific Coast district (California and Washington) showed a decrease of about 12%. Important increases in production and shipments were shown by New York, the Iowa-Missouri district, the Maryland-Virginia-West Virginia district, and the Rocky Mountain district.

Important Books of 1914

Among the more important books on mining and metallurgy published during 1914 were the following:

Brunton, David W., and Davis, John A. "Modern Tunneling, with Special Reference to Mine and Water-Supply Tunnels." (450 pp., $3.50).

Eckel, Edwin C. "Iron Ores; Their Occurrence, Valuation and Control." (430 pp., $4.)

Emery, George D. "The Miners' Manual." A Handbook of the Law of Mines and Mining, with Forms. (436 pp., $3.50.)

"Engineering and Mining Journal" Editorial Staff. "Handbook of Milling Details." (425 pp., $4.)

Gowland, Wm. "The Metallurgy of the Non-ferrous Metals." (500 pp.)

Hofman, H. O. "Metallurgy of Copper." (556 pp., $5.)

Hoover, T. J. "Concentrating Ores by Flotation." Revised edition. (270 pp., $3.75.)

Jones, E. Horton. "Smelter Construction Costs." (152 pp., $2.)

Krusch, P. "Die Untersuchung und Bewertung von Erzlagerstätten." Second edition. (569 pp., 17 marks.)

Lindley, Curtis H. "A Treatise on the American Law Relating to Mines and Mineral Lands, Etc." Third edition. (Three volumes, 2813 pp., $25.)

Megraw, H. A., "Details of Cyanide Practice." (215 pp., $2.)

Paine, Paul M. and Stroud, B. K. "Oil Production Methods." (239 pp., $3.)

Ries, Heinrich, and Watson, Thos. L. "Engineering Geology." (672 pp., $4.)

Stansfield, Alfred. "The Electric Furnace." Second edition, revised. (415 pp., $4.)

Wilson, Alfred W. G. "The Copper Smelting Industries of Canada. (184 pp.)

Iron and Steel

By Frederick Hobart

The year 1914 will be remembered as one of those in which the iron and steel production and prices reached what appears to us now a low-water mark, although not very long ago the figures of the year would have represented a boom. The production decreased nearly 25% from the high record set in 1913. Prices worked down to a low point chiefly on account of small demand and a certain degree of competition. It must be remembered that under the new tariff there would be a limit to the point to which prices would rise, even under strenuous demand; that is, under ordinary circumstances. The conditions of 1914, however, were not ordinary, and the prices seemed to be hunting for the minimum rather than the maximum points. The falling off in demand was met, as a rule, by reducing production, and, at the end of the year, there seems to have been comparatively little accumulation of unsold stocks to weigh down makers. The rate of steel production at the mills was, at times during the year, as low as 30% of the nominal capacity, taking a general average. Full capacity, however, that is, the total productive capacity of which a mill is capable when run at the highest speed, is a point very seldom reached, and then only for a very few days, so that it would be, perhaps, safer to put the real capacity of the mill at somewhere between 80 and 90% of its nominal capacity.

The year opened with a falling off in production which had commenced near the close of 1913. The depression was due at that time to a reaction from the very heavy work of 1913, when the country undoubtedly over-bought and over-traded. For several months the declining condition continued; there was no heavy slump, as in 1907 and the early months of 1908, but a continued decline in purchasing and in production. As the middle of the year approached, there seemed to be an improvement; the manufacturing and financial conditions were somewhat better, so that there was hope for a return to normal prosperity later on. The breaking out of the war in Europe, however, at the close of July, changed all this immediately. The unprecedented extent of the contest there disorganized all financial conditions and for a time the iron trade halted, apparently in total uncertainty of what was coming. A few people anticipated a rush of prosperity for us, resulting from the stoppage of manufacturing abroad. The greater number, however, realized that in the present condition of the world's trade, no nation can hope to profit for any considerable time or to any large amount by its neighbor's troubles.

Buying of iron and steel by the railroads was, for the most part of the year, on rather a limited scale. The financial conditions prevented most railroad companies from raising money freely for improvements and additions to their property. Moreover, for several months, the companies had pending before the Interstate Commerce Commission requests for authority to increase rates on freight, claiming that the established rates were not sufficient to enable them to to spend the necessary amount on the maintenance and improvements of their properties. While such a question was being argued, it is perhaps natural that they should seek to support their claims by limiting their expenditures. Indeed, many roads were really not able to spend money as freely as they have been doing for several years. At a comparatively late period of the year, permission to increase rates to some extent was granted; but the relief so given was not sufficient to bring the companies into the field to any great extent. In the coming year, however, many of them will be compelled to invest considerable sums for new tracks and equipment.

As the year closes, there is a notable improvement in sentiment, and a greater disposition to confidence in the future. This has been supplemented and supported by an increase in actual purchasing and manufacture, which seems to be decidedly encouraging. As 1914 opened with a depressed and gloomy outlook, it closed with decidedly brighter prospects for its successor.

Iron Ore

The production and consumption of iron ore, which reached a record figure in 1913, showed a material reduction in 1914. Approximate figures are given in Table I herewith:

I. IRON ORE PRODUCTION AND CONSUMPTION

(In Long Tons)

	1912	1913	1914
Lake Superior shipments	48,211,778	49,947,116	33,721,897
Southern ore mined	7,500,000	7,950,000	6,175,000
Eastern and other local ores	3,485,000	3,950,000	3,015,000
Total production	59,196,778	61,847,116	42,911,897
Imports	2,104,576	2,594,876	1,455,000
Total supplies	61,301,354	64,441,992	44,366,897
Exports	1,195,742	1,042,151	660,000
Approximate consumption	60,105,612	63,399,841	43,706,897

Exports and imports are estimated for two months, November and December. No account has been taken in Table I of changes in stocks at the end of the respective years. In 1914 there was no material change in visible stocks. It is impossible to estimate the ore in furnace yards, owing to the absence of available data.

Deliveries of Lake ore to Lake Michigan ports in 1914 were 6,109,019 tons; the larger deliveries being 3,606,587 tons at South Chicago; 1,431,564 tons at Gary; 661,054 tons at Indiana Harbor.

The increased use of Eastern ores continued in 1914, though limited, of course, by the smaller demand for ores generally. The Southern output of ores follows rather closely the needs of the furnaces. In 1914 there was little work done on new mines or on the development of old ones.

Cuba, Sweden and Newfoundland were the chief sources of foreign ores. A beginning was made of imports from the Tofo iron mines in Chile, acquired by the Bethlehem Steel Co. in 1913, but the ore from those mines did not reach this country until late in 1914, and then only in moderate quantity.

Exports in 1914, as in the previous year, were chiefly of Lake ore to Canadian furnaces, some of them being large buyers, as at Midland and Hamilton.

Table II gives the total shipments from the Lake Superior region in 1913 and 1914, the rail shipments in 1914 being estimated. The dock statistics, which are collected by the *Marine Review,* give the figures in long tons.

II. LAKE IRON ORE SHIPMENTS

	1913		1914	
	Tons	Per Cent.	Tons	Per Cent.
Escanaba	5,399,444	11.0	3,664,451	11.5
Marquette	3,137,617	6.4	1,755,726	5.5
Ashland	4,338,230	8.9	3,363,419	10.5
Two Harbors	10,075,718	20.6	5,610,262	17.5
Superior	13,788,343	27.9	11,309,748	35.3
Duluth	12,331,126	25.2	6,318,291	19.7
Total water	49,070,478	100.0	32,021,897	100.0
Rail shipments	876,638	.....	700,000	.....
Total	49,947,116	.....	32,721,897	.....

This table shows that the shipments for 1914 were the smallest in ten years, except those of 1908; though they were only 108,514 below those of 1911. The changes in the port shipments show that the Steel Corporation directed its efforts toward making up its minimum on the Hill leases, doing comparatively little on its other mines. This is plainly shown by the increase in the proportion shipped from Superior, coupled with the decreases at Duluth and Two Harbors. From the Minnesota ranges, the Mesabi and the Vermilion, the proportion did not change greatly, being 73.7% of the total in 1913 and 72.5% in 1914. These figures are approximate only, the production not being apportioned by ranges as yet.

The shipments to furnaces from lower Lake ports were well up to receipts, and the stocks on docks Dec. 1, 1914, were less than 100,000 tons greater than at the close of the preceding season.

Pig Iron

The production of pig iron by half years for four years has been as in Table III; the first half of 1914 being the corrected figures of the Iron & Steel Institute, the second half estimated from the monthly statements of the furnaces:

III. PIG IRON PRODUCTION BY HALF-YEARS

	1911	1912	1913	1914
First half	11,665,796	14,072,274	16,488,602	12,536,094
Second half	11,983,548	15,654,873	14,477,699	10,720,000
Year	23,649,344	29,727,147	30,966,301	23,256,094

The total for 1914 shows a decrease from 1913 of 7,710,058 tons, or 24.9%; it was less than the small make of 1911 by 393,250 tons; and only the entirely exceptional year 1908 shows a smaller make in recent years. In Table IV the production for 12 years is given, in long tons, which are used in all the tables of iron production.

IV. PIG IRON PRODUCTION FOR 12 YEARS

1903	18,009,252	1907	25,781,381	1911	23,649,344
1904	16,497,003	1908	15,936,018	1912	29,727,147
1905	22,992,380	1909	25,711,846	1913	30,966,301
1906	25,307,391	1910	23,649,344	1914	23,256,094

The increase in capacity for making pig iron is shown by the fact that in 1914, which is considered a lean year by comparison with its predecessors, the total make was only about 2,000,000 tons less than in 1906 and 1907, which were boom years, when furnaces were run up to their capacity under the stimulus of active demand and high prices. In the seven years from 1907 to 1914 the blast-furnace capacity of the country has been increased about 25%; and a lean year now is almost equal to the the boom year of seven years ago.

The various classes of pig in the second half probably differed little from those made in the first half in proportion. Assuming that the division was the same, the production of pig iron for the year, classified according to intended uses, is given in Table V:

V. PIG IRON PRODUCTION BY GRADES

	1913		1914	
	Tons	Per Cent.	Tons	Per Cent.
Basic	12,537,746	40.5	9,298,647	40.0
Bessemer	11,593,385	37.4	8,130,098	35.0
Foundry	6,213,654	20.1	5,249,079	22.6
Forge, etc	391,682	1.3	405,756	1.7
Spiegel and ferro	229,834	0.7	172,514	0.7
Total	30,966,301	100.0	23,256,094	100.0

In Table V, low phosphorus is included with bessemer pig; ferrosilicon with foundry; a small tonnage of miscellaneous with forge pig.

The consumption of pig iron for two years past is shown in Table VI, exports and imports for the last two months of 1914 being estimated.

VI. CONSUMPTION OF PIG IRON

	1913	1914	Changes
Production	30,966,152	23,256,094	D. 7,710,058
Imports	156,435	147,200	D. 9,235
Total supply	31,122,587	23,403,294	D. 7,719,293
Exports	277,648	117,000	D. 160,648
Increase in stocks	500,000	750,000	I. 250,000
Total deductions	777,648	867,000	I. 89,352
Approximate consumption	30,344,939	22,536,294	D. 7,808,645

There are no very reliable figures as to stocks unused or unsold; but it is believed that in 1914 decreased demand was met rather by blowing out furnaces than by piling up iron. The imports of pig iron have shown a decrease, notwithstanding the removal of the duty.

The complete returns of foreign trade to the end of October, as made up by the Bureau of Commerce, are given in Table VII:

VII. VALUES OF FOREIGN TRADE
(10 Months to Oct. 31.)

	1912	1913	1914
Exports	$238,971,131	$251,676,318	$169,232,670
Imports	23,885,776	28,292,118	24,947,236
Excess, exports	$215,085,355	$223,384,200	$144,285,434

The closing months of the year have probably made a better showing; but a large decrease in exports is certain.

Steel

While there are no published or completed figures as to the production of steel, it is fair to estimate that the decrease from 1913 to 1914 was 25%, or about the same as that in pig iron, which would indicate a total of 23,475,000 tons of ingots, and some 22,000,000 tons of finished steel. It appears probable that the completed statistics will show about 25% decrease in structural steel, bars and plates, somewhat smaller losses in sheets and wire, and a loss of over 1,000,000 tons, or 30%, in rails.

United States Steel Corporation

The Steel Corporation, with other producers, felt the stress of reduced demand, and after paying the common-stock dividend for the second quarter of 1914 from accumulated surplus, reduced the dividend for the third quarter from 1¼ to 0½%. It was reported that a general reduction in wages would be made on Jan. 1, 1915, but recently it was announced that no reduction would be made; and this action will be followed by the leading independent producers.

Foreign Countries

Great Britain has furnished no statement for any part of the year. In 1913 the make of pig iron was 10,479,171 tons, and that of steel was 7,663,876 tons. It is believed that 1914 will show decreases of about 10% from these figures.

For Germany we have figures up to Sept. 30. In the nine months ended on that date, the production of pig iron was 11,996,652 metric tons, a decrease of 2,459,434 tons from 1913. The production of steel was 12,223,486 tons. The effect of the war is shown by the fact that pig-iron production in September, 1913, was 1,590,849 tons, while in September, 1914, it was 518,184 tons. The production of steel decreased from 1,627,345 tons in July to 663,223 tons in September.

Pittsburgh Iron and Steel Markets

By B. E. V. Luty*

There was a general decline in prices and in activity in the iron and steel trade in 1914, but as the year opened with conditions decidedly unsatisfactory, and as, furthermore, there were at intervals periods of slight improvement, the total ground lost during the year was not great. The market had weakened almost continuously in 1913, but in the closing days of the year a slight improvement was manifested, and this improvement became more marked in January, but the recovery proved to be only a slight one and the downward trend was soon resumed. Again, about the beginning of June the market started to recover, and definite ground was gained in that month and the next. The shock of the war breaking out at the beginning of August halted business for a few days, this being followed by a slight burst of feverish activity, it being assumed in some quarters that the war would make certain raw materials scarce and would at the same time develop a large demand for export steel, both in war material and in business with neutral countries, whose supplies from the warring countries would be shut off.

AVERAGE PRICES AT PITTSBURGH, 1914

	Pig Iron					Steel				Nails	
	Bessemer	Basic	No. 2 Foundry	Ferro-manganese	Bessemer Billets	Beams	Plates	Bars	Black Sheets No. 28	Wire per Keg	Cut per Keg
January	$14.94	$13.23	$13.90	$45.58	$20.00	1.20c.	1.20c.	1.20c.	1.86c.	$1.53	$1.60
February	15.13	13.96	14.11	40.49	21.00	1.25	1.21	1.22	1.95	1.60	1.60
March	15.07	13.94	14.15	40.56	21.00	1.21	1.18	1.20	1.95	1.60	1.60
April	14.90	13.90	14.15	40.16	20.75	1.18	1.15	1.15	1.90	1.60	1.60
May	14.90	13.90	14.07	40.16	20.00	1.15	1.14	1.14	1.85	1.58	1.60
June	14.90	13.90	13.90	40.16	19.50	1.12	1.10	1.12	1.82	1.50	1.58
July	14.90	13.90	13.90	39.66	19.50	1.12	1.11	1.12	1.80	1.52	1.55
August	14.90	13.90	13.90	110.00	20.17	1.18	1.18	1.18	1.88	1.57	1.55
September	14.90	13.90	13.75	85.00	20.75	1.20	1.19	1.19	1.98	1.60	1.55
October	14.84	13.75	13.75	70.16	20.00	1.16	1.14	1.15	1.96	1.60	1.55
November	14.59	13.43	13.50	70.16	19.25	1.11	1.09	1.11	1.88	1.59	1.55
December	14.70	13.45	13.60	70.16	18.50	1.05	1.05	1.05	1.85	1.50	1.55
Year	14.89	13.76	13.89	57.79	20.03	1.16	1.14	1.15	1.89	1.57	1.57
Year 1913	17.10	15.55	15.78	60.03	25.55	1.42	1.41	1.37	2.21	1.70	1.66

Prices of pig iron, ferromanganese and billets are per ton, 2240 lb.; of steel products, per lb.; of nails, per 100 lb., base.

This delusion did not prevail generally and was soon dispelled. The trade dropped to a greater depth of inactivity than had ever before obtained in its history, the middle of November seeing steel-mill operations averaging not over 35% of capacity. In November trade sentiment generally changed from hopelessness to expectancy, and in December a slight increase in buying occurred, the decline in prices being at the same time practically arrested; but the improvement was not sufficient to effect a noticeable increase in mill operations.

According to the precedents, 1914 should have been a year of recovery in the iron and steel trade. The feverish and unreasonable burst of buying which characterized 1909 required nearly two years of liquidation, 1910 and the major part of 1911; the buying movement of 1912 was of much more moderate proportions and the slight excesses of that period should have been fully made up for in 1913; but conditions at the beginning of 1914 were particularly inauspicious, and the great European war came later to give the industry a fresh and serious setback.

On account of the largely reduced tariff which became effective Oct. 4, 1913, the iron and steel trade was greatly unsettled. While actual imports were so light as to be practically negligible, the usual incentive to buyers, fear of a rapidly advancing market, was practically removed. A further unfavorable influence was the condition of the railroads. They had been prosecuting an almost continuous contest with the Interstate Commerce Commission for leave to advance rates, meanwhile curtailing their expenditures, largely because no other course was open, but in some part probably for the purpose of influencing public sentiment. During the second quarter of the year there were hopes that a favorable decision in the "Eastern Rate Case" would stimulate buying both by the railroads and by others who commonly followed the example of the railroads, but the partially favorable decision was not rendered until Aug. 1 and then the war prevented the improvement that might otherwise have followed.

The war exerted a serious adverse influence upon the iron and steel trade by making everyone extremely conservative and by tieing up funds, so that banking accommodations for ordinary commercial operations were greatly restricted and the financing of new projects was almost entirely prevented. As to the railroads, the question whether they would be able to obtain funds for extensions yielded to the question whether they would be able to obtain money for ordinary refunding. As projects that were in course were completed mill activity had to decrease for fresh projects did not take their place.

Pig-iron prices suffered an average decline during 1914 of about 50c. a ton, even though there was a slight recovery in February. Finished-steel prices experienced an average decline of about $2 a ton during the year, with no material recovery at any time.

Pig-iron production in 1914 was about 23,250,000 gross tons, a decrease of 25% from the record production of 30,966,301 tons made in 1913. Steel production decreased by a still larger percentage, for during the major portion of the second half of the year the steel works were accumulating pig iron, not deeming it economy to blow out blast furnaces to the same extent that steel works operations were curtailed. In the latter part of the year curtailment to the full extent of the decreased demand was necessary since it is impossible to make finished steel for stock.

The war completely stopped German and Belgian exports of steel, such exports having previously constituted more than one-third the total exports to the neutral markets of the world, but on account of financial conditions

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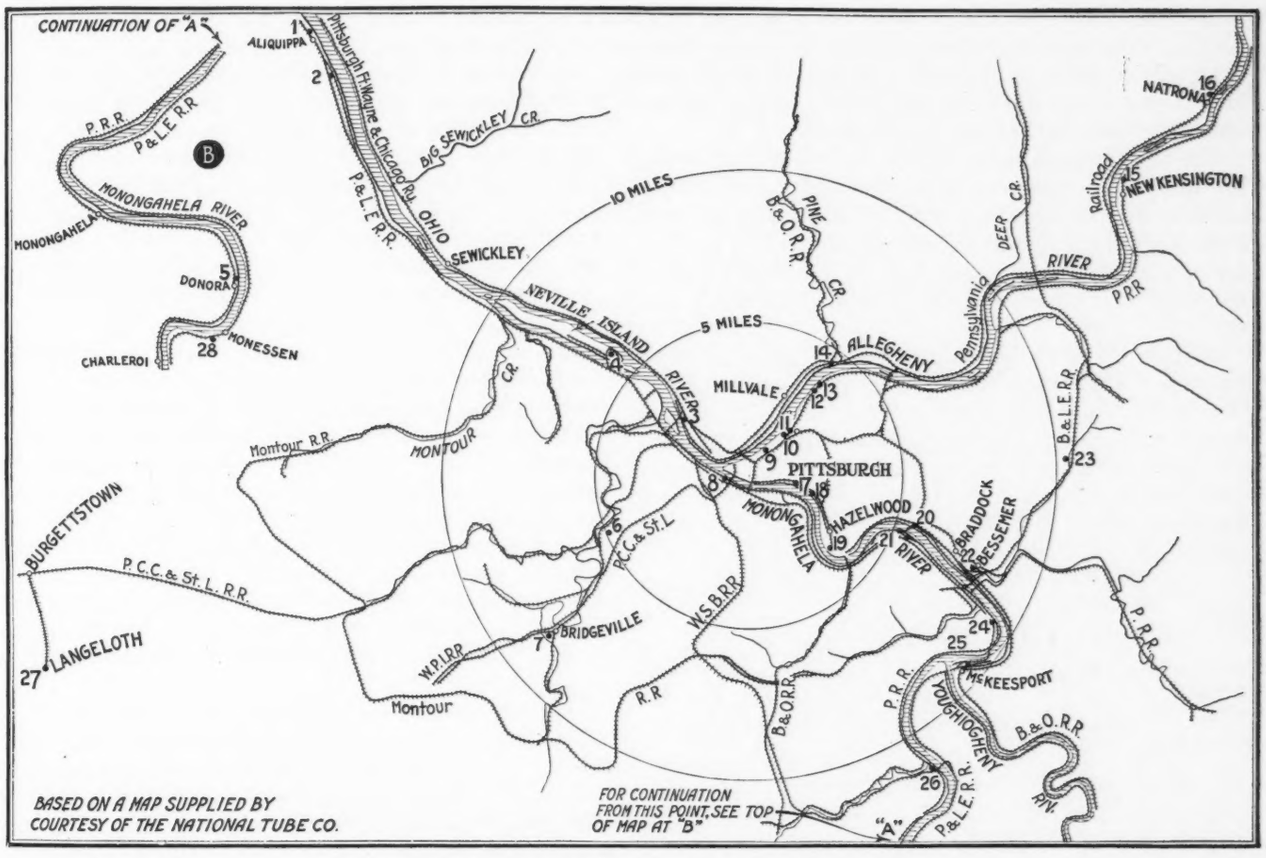
occasioned by the war the buying power of neutral countries was decreased in still greater measure, so that the exports of both England and the United States suffered sharp decreases. Largely by reason of a special demand for war material, the export trade of the United States began to improve after August, the October exports of tonnage products being 147,000 gross tons or a trifle greater than the monthly average of the seven months of the year prior to the war. The rate was still far below the average in 1912 and 1913, the best foreign trade in years, when exports were 225,000 to 250,000 tons a month.

Vanadium

The situation of this metal was about the same in 1914 as in the previous year, but prices were a little weaker. There has been an over-production of vanadium, and since the war the continental demand has dropped to practically nothing, shipments even to neutral countries being impossible without a special permit of the government of the country of destination. In the United States, buying is but from hand to mouth, and naturally the smelters are able to buy ore only in the same way.

Lake Superior Iron Ranges

The 1914 season on the iron ranges more than bore out the doleful prospects of the fall of 1913. Total shipments were reduced by 34 or 35% from 1913, and whereas the latter year was a record breaker, nevertheless the reduction was so heavy as to make 1914 the worst since 1908. Of the several ranges, the region around Crystal Falls and Iron River probably suffered the most. The Marquette and the Mesabi ranges bore more than their share of the reduction, while the Vermilion and Gogebic ranges certainly, and the Iron Mountain district probably, did better than the average; the Cuyuna range even made a slight gain.



PITTSBURGH AND VICINITY—THE IRON DISTRICT

1, Vulcan Crucible Steel Co.; 2, Jones & Laughlin Steel Co.; 3, Carnegie Steel Co. (Edith furnace); 4, Carnegie Steel Co. (Neville furnace); 5, American Steel & Wire Co. (Donora works); 6, Carbon Steel Co. (Carnegie plant); 7, American Vanadium Co.; 8, Clinton Iron & Steel Co.; 9, American Steel & Wire Co.; 10, Carbon Steel Co.; 11, Crucible Steel Co. (Park works); 12, Crucible Steel Co. (Crescent furnaces); 13, Carnegie Steel Co. (Lucy furnaces); 14, Carnegie Steel Co. (Isabella furnaces); 15, Aluminum Co. of America; 16, Pennsylvania Salt Mfg. Co.; 17, Jones & Laughlin Steel Co. (Soho furnaces); 18, Jones & Laughlin Steel Co. (Eliza furnace); 19, Pittsburgh Smelting & Refining Co.; 20, Carnegie Steel Co. (Carrie furnace); 21, Carnegie Steel Co. (Homestead works); 22, Carnegie Steel Co. (Edgar Thompson works); 23, Universal Portland Cement Co.; 24, Carnegie Steel Co. (Duquesne works); 25, National Tube Co.; 26, Carnegie Steel Co. (Clairton works); 27, American Zinc & Chemical Co.; 28, Pittsburg Steel Co. (Monessen plant).

Mesabi Range

The Mesabi shipments suffered a reduction from about 34,000,000 tons to 21,362,056. Of this, about 13,250,000 tons was shipped by the Oliver company, about 60% of the total. The proportion of total Lake shipments made by the Mesabi remained about the same as for 1913, 66%. The mines leased from the state suffered severely. The 1913 shipments were 2,874,940; those for 1914 were only 804,722. The state's tonnage reserves, as estimated for May 1, 1914, were as follows: School lands, 105,635,410; swamp lands, 30,470,666; university lands, 5,438,047.

While shipments decreased severely, activity in general

was not restricted in proportion. This is due to the fact that the Oliver company was engaged in opening up new mines to take the place of those turned back to the Hill interests, while the Hill interests were also busy developing, since many of the mines relinquished by the Oliver are either pretty well worked out or require extensive development work before being capable of any great production. The Dale, North and South Uno, Harold and Mississippi mines, however, will be in a position to operate actively in 1915. At least a dozen new properties controlled by the Steel Corporation started to operate during 1914, and while some of the Corporation properties were idle, most of the suspensions, for part or all of the season, were made by independent operators.

The Oliver company did a good deal of drilling during the year under contracts calling for early completion of exploration. At one time 120 machines were at work. Part of the drilling was in the nature of check work, or for extension of exploration, but on the eastern part of the range it is understood that extensive ore was opened up.

On this end of the range the Vivian continued operations on a small scale, the Graham increased its production from the openpits, and the Weed completed installation of equipment. The Miller, the Mohawk, the Hudson, the Meadow, the Adriatic, and the Knox continued operations at no great reductions over the scale of 1913. Around Biwabik the Bangor, the Biwabik, the Ruddy, and the Monica shipped at a reduced rate, while the Holland and the Belgrade, idle last year, made small shipments. The Williams did not ship.

In the Gilbert district the Corsica and the Elba curtailed operations, while the Malta was idle. The Oliver company completed dismantling the Gilbert. The Republic company increased shipments from the Pettit, but the Schley produced only a little ore.

In the Eveleth district Genoa shipments were cut in half. The work here is largely scramming, for which there is employed a Marion revolving shovel, the first used by the Oliver company. It has given excellent satisfaction. The Fayal openpit operated on a small scale during the shipping season; at No. 2 underground work was about as usual; No. 1 was closed down in April at the expiration of the lease; it is not known whether an extension has been granted. The Adams and the Spruce produced at a reduced rate, as did the Virginia. The Troy and the Morrow were idle.

Around Virginia the Norman is about exhausted. It is the first large openpit to come to this point, and in its present condition exhibits splendidly the nature and shape of a typical deep-trough Mesabi orebody. The Union, the Franklin, the Missabe Mountain, the Fay, the Sliver and the Commodore shipped less than in 1913; the Minorca and the Lincoln shipped about the same as in 1913; the Larkin was idle and the Onondaga was abandoned; it is understood that the orebody was exhausted. The Alpena shipped over 1,110,000 tons and stocked a large tonnage as well. Operations were pushed here, as in 1913, on account of the approaching termination of the lease. The Oliver started three new mines in the district, namely, the Prindle, the Sullivan and the Minnewas. Operations at the Commodore have been suspended and this deep pit allowed to fill with water. Early in the season water broke through into the Lincoln and operations were suspended for several weeks. Butler Bros. completed its stripping contract on the Sliver in May.

In the Mountain Iron district the Hanna, of the Consumers Ore Co., did not ship, but mined out underground workings adjacent to the pit and stocked the product in the pit. The Hanna B mined about 100,000 tons and passed it through the Brunt drier. The Brunt did not ship, but carried on stripping. The drying plant had a successful season, marked by an absence of breakdowns. The Iroquois did not operate but shipped a stockpile.

In the Buhl district the Whiteside drier sent about 200,000 tons of product to the docks, although the mine did not operate. The Helmer and the Eaton shipped and the Woodbridge shipped from stockpile. At the Frantz, closed since 1907, active surface construction work was done. The Arthur company now has the Dean ready for production, and it is understod that Tod-Stambaugh will handle it in 1915. The Arthur is sinking a shaft on the Thorne, which will be ready as an underground property in 1915. The Oliver completed equipment of the Shiras and Wanless and sank a shaft on the Deacon.

In the Chisholm district the Shenango operated at about 75% capacity and during the year put down an incline on the south side of the pit, by which about 1,250,000 tons of underground ore will be mined. Surface equipment was installed and underground development begun on the Duncan, a new Oliver mine. Stripping operations on the Dunwoody continued, and the large openpit is about ready for shipment. The Arthur company operated the South Leonard. The Oliver exhausted most of the tonnage of the Leonard, preliminary to turning it back to the Arthur. The Clark and Chisholm increased their shipments in 1913, and the Monroe-Tener operated, but did not ship.

The Hibbing district was probably adversely affected more than any other district along the range. The Sellers pit did not operate at all; the Burt-Day produced less than half of its 1913 production; the Hull-Rust produced only about one-eighth and the Unos operated on a small scale. The Susquehanna produced little more than half its 1913 tonnage; the Scranton did not ship; the Albany shipped about a third; the Webb was idle; the Winifred shipped a little. Only the Mahoning, among the large mines, operated at a normal rate, although the Mace operated at about usual capacity. The Dale produced a small tonnage; the Arthur company started operations on the north bank of this openpit and did some underground mining at the North Uno. It has leased to Tod-Stambaugh part of Sec. 11-57-21. The Eddy property adjoining the Morton of Tod-Stambaugh will be operated in conjunction with the latter. The Longyear will be ready to ship in 1915. The Laura and the Leetonia shipped all season. At the Agnew surface repair work was carried on. The Oliver is opening up the Philbin as an underground mine and is stripping the Sheridan-Fletcher. The Smith property of the Arthur is ready for shipment.

Around Nashwauk, the Wisconsin Steel sent a fair tonnage to its washery and did some surface construction work. The La Rue operated its experimental washing plant on a commercial basis, producing about 25,000 tons of product; Butler Bros. completed stripping this property, and some extensive drilling also was finished in June. Butler Bros. took under lease from the Arthur, the East-Harrison, and began stripping. This lease involves a contract to erect a washery. The Mississippi was turned

over to the Arthur by the Oliver. The St. Paul was not operated but did a little stripping. The Bennett shipped and continued stripping.

The Jones-Laughlin interests around Grand Rapids were forced to abandon their dredge, but continued shaft sinking in Sec. 13-55-26. The option on the Buckeye was given up and all operations were suspended early in October, but it is understood that work may be resumed when business conditions warrant. At Coleraine the Canisteo pit operated practically the same as in 1913 and the Trout Lake washery produced over a million tons of concentrates from this mine alone. The Judd and the Hill produced about as in 1913, while the Holman-North Star produced about one-half. On the Hill Annex, A. Guthrie & Co. took the largest stripping contract ever awarded on the range, namely, to remove 8,500,000 cu.yd. Elaborate and heavy equipment is being used for this job. Shaft sinking on the Hill Annex and the driving of drainage drifts have been completed by the Arthur company. Eventually, this property will require a washing plant.

The Cuyuna

The Cuyuna has the distinction of being the only iron range to exceed its 1913 production. Shipments were approximately 873,000 tons. The heaviest shipper was Armour No. 2 with 288,000 tons. The cutting off of foreign manganese supplies directed renewed attention to the Cuyuna deposits of maganiferous material, but interest abated suddenly on the publication of the Minnesota State Tax Commission's opinion that the material was of doubtful value, and that there was no commercial manganese ore on the range. Nevertheless, the Cuyuna-Mille Lacs, the leading producer of this material, shipped over 51,000 tons.

There was little in the line of new discovery during the year, and the limited exploration work was confined mostly to land adjacent to the known deposits. Some tonnage was opened up near Emily, at the extreme northern end of Crow Wing County, but actual results are not known. In Aitkin County, at the eastern end of the range, some high-manganese iron ore was disclosed.

The South range had a bad setback following the abandonment of the Barrows mine, although this was the result rather of trade conditions and of initial mismanagement. The Brainerd-Cuyuna is the only other active enterprise in the vicinity. It about completed getting its drop shaft, the third sinking attempt, to the ledge. Water and quicksand make sinking on the South range exceedingly difficult. East of Brainerd the Wilcox mine of the Canadian-Cuyuna sunk a shaft; this company has Canadian affiliations and is expected to ship ore outside the country in 1915.

The large consuming interests still stand aloof from the range, and Jones & Laughlin, late in the year, dropped all options after some exploration work. John A. Savage, however, is sinking a concrete drop shaft on the Jamison & Peacock forty, north of Crosby, the only known deposit of bessemer ore on the range.

Stripping the Thompson pit was completed and stripping operations planned for the Hill Crest, the Cuyuna Iron & Manganese, and the Cuyuna-Sultana, all near the Pennington, during 1915. The possible stripping area is now generally conceded to be restricted to an area extending west from Crosby to Riverton. The partial success of the hydraulic method of removal at the Rowe mine has led to the decision to employ it for part of the overburden on the Hill Crest. The Armour No. 2, Barrows, Cuyuna-Duluth, Cuyuna-Mille Lacs, Iron Mountain, Kennedy, Rowe and Thompson shipped during the year. The Armour No. 1, Pennington, Duluth-Brainerd, Meacham and Adams could have shipped, but did not.

Late in the year the State Tax Commission applied the same system of taxation to the Cuyuna as has been used on the other Minnesota ranges, and published its tonnage estimate, namely, 86,179,791 tons, of which 70,357,865 tons was classed as merchantable ore.

The Soo line still handles the bulk of the tonnage, about 85%. Next year the N. P. will handle the product of the Croft, Wilcox and Brainerd-Cuyuna, as well as the Duluth-Brainerd if that is shipped. Railroad construction and the struggle for tonnage went on during the year. The announcement of the projected building of a concentrator for the Rowe mine was a matter of great importance to the range.

Considering the disadvantages under which the range labors, namely, the absence of the larger companies, the difficulties of sinking, the exaggeration of the stock companies, the lack of bessemer ore, etc., the increase in production by 20% over 1913 is a matter of congratulation.

Vermilion Range

Relatively speaking, the Vermilion had a successful season, its reduction in shipments being only between 32% and 33%, that is, the shipments were 1,017,019 tons, as against 1,512,399 for 1913. As usual, the Oliver Iron Mining Co. produced the bulk of the ore, namely, 931,077 tons. The remainder came from the Section 30 mine, now operated by St. Clair interests.

The old Minnesota mine was closed for repairs during part of the year. Recent developments indicate that the deposit is still far from exhausted. None of the several prospects on which work has been done during the last few years has yet entered the shipping list. The Onahman has developed a little ore, however. A noteworthy event was the closing down of the North American. This property has been exploited at various times for iron, gold, silver and graphite, but in November the pumps were shut down and the mine allowed to fill.

The Marquette

The Marquette range and the tributary districts suffered severely in 1914, the total shipments, partly estimated, being 2,471,000 tons, a reduction of 37% to 38% from 1914. As usual, the Cleveland-Cliffs headed the list of shipments with 1,365,000 tons.

A notable event of the year was the passing of the control of the Republic mine from the Cambria company to the Cleveland-Cliffs. The latter carried on a good deal of surface construction work, including building a concrete dam at Lake Michigamme. It did drilling on the Barnes land, west of Ishpeming, and unwatered the old Dexter mine. The Volunteer also drilled on its lands at Palmer, locating some ore.

The No. 7 Hard Ore mine, the Breitung Hematite and the Mary Charlotte were closed down during the year. The Milwaukee-Davis and the Barron were abandoned. The Cleveland-Cliffs reduced forces, closed mines and cut wages, and wage cuts were general with the other companies.

Jones & Laughlin continued sinking at Iron Mountain

Lake, and the Breitung Hematite is opening a new mine at Negaunee to be called the Lucky Star. Cleveland-Cliffs continued sinking its Athens shaft and did development work at the Mackinaw and Gardner. The Cascade completed its shaft and started drifting in the ore. The American-Boston closed its American mine for repairs, but reopened. The Jones & Laughlin Lake Angeline is about to be definitely abandoned.

Gogebic Range

Complete shipments from the Gogebic for the year were 3,363,419 tons, a reduction of only about 26% from 1913, probably the best showing of any range except the Cuyuna. The Asteroid, Castile, Colby, Ironton, Mikado, Windsor, and Yale were shut down altogether on account of the poor state of the market, but it is expected they will be opened again as soon as business conditions improve.

The Wakefield, of the M. A. Hanna Co., was stripped to the producing stage this year, and about 350,000 tons of ore shipped. Additional stripping is still required. This is the only steam-shovel openpit in Michigan. Construction and development work was continued at the Palms-Anvil property of the Newport mine, and late in the year announcement was made of a new shaft to be sunk at the Newport proper.

Luther Brewer, of Ironwood, and some Milwaukee people did some drilling in the Wakefield district, but the results are not obtainable. Oglebay-Norton found a new deposit of ore in the Ottowa mine and expects to sink a shaft in 1915.

Iron River-Crystal Falls

While figures on shipments are not available, it seems probable that the Iron River-Crystal Falls region suffered more than any other, due to the fact that its characteristic high phosphorus ore is the first to feel a depression in the ore market. A good deal of construction work and some exploration was carried on, nevertheless.

In Sec. 30-43-32 some drilling was done by Minnesota interests, and after these interests threw up the option the Cole & McDonald Exploration Co. took it up and continued drilling. The Bristol Mining Co. did some drilling on a property west of the Bristol mine and is said to have had excellent results. The Longyear company continued drilling between Crystal Falls and Iron River without definite results. The St. Clair Exploration Co. drilled Sec. 26-43-35, and is reported to have cut ore. Some underground and check drilling was done by various companies.

During the year work was done on the Hilltop and Warner mines, but they were later abandoned. The Bates operated to some extent during the year, but did not ship. The Davidson mine operated about as usual and installed some new machinery. Oglebay-Norton had an extremely slack season; the Chatham and Berkshire were scarcely worked at all, the Bristol for less than half the year. Pickands-Mather worked only the Caspian; the Fogarty, Bengal and Baltic were idle. Shipments from stockpile were made from most of these mines, however. Near the village of Amasa the Hemlock has about breathed its last; but the Longyear-Hartley interests have begun active development on the Porter mine, which contains a fair amount of bessemer ore. Of the Wickwire mines, the Cortland, the Homer, and the Wickwire were worked to some extent and small shipments made. The Virgil was idle through the year. Corrigan-McKinney worked out and abandoned the Armenia, worked the Baker for half a year and made shipments, but kept the Tobin and Great Western idle for all of the year. Development work and a little shipment was made from the Dunn; a good deal of development work and surface construction was carried on at the Tully and some shipments made. The Rogers mine of the Rogers-Brown interests made its first shipment this year. The Hiawatha worked at its usual rate for most of the year, but a mine fire in the slate hanging wall required it to be shut down in October. At the Chicagon the work went on about as usual. The Carpenter, of the Hanna company, entered the shipping list in 1914. An electric generating plant installed here furnishes power for the Ravenna, which is electrically equipped, as is the Carpenter. The company abandoned the Hollister.

At the Balkan, Winston Bros. started stripping in April. The use of drag-line excavators is an innovation on this job. Surface construction and the installation of machinery was carried on during the year, and the shaft completed for drainage purposes. At the adjacent Judson the shaft was carried down far enough to permit mining in a small way on the first level. Crosscutting, drifting, and the installation of machinery completed the work for the year. Several thousand tons of ore were hoisted, but no shipments were made.

Iron Mountain Region

Twelve mines shipped from the Menominee range proper during 1914, but figures on shipments are not available. Most of the mines operated during part of the year, most of them also closed down later. Among those closing down were the Traders, the Walpole, the Millie, the Penn, and the Monroe. Those that are still working have reduced forces or cut the number of working days. There was no drilling of any importance conducted during the year, and no new mines were opened. An attempt at reopening the Indiana, now controlled by the Thomas Furnace Co., of Milwaukee, was made, and, in fact, unwatering was pretty well completed when orders to cease were received.

Sulphur in 1914

The principal producer of sulphur in the United States, as heretofore, was the Union Sulphur Co., the production of which, in 1914, was about 375,000 long tons. Some of the largest producing wells ever brought in were pumped in 1914, and, in consequence, steaming operations were much reduced; only three wells were being pumped at the end of the year. The company increased its large stock of sulphur at Sulphur, La., notwithstanding that it operated only half its steaming plants in 1914. The disturbed conditions in Europe interrupted the demand there, and shipping conditions helped to demoralize that market. At its four European distributing stations, the company had fair stocks at the end of 1914, though hardly sufficient to supply the demands that arise at this time. The company's refineries at Cette and at Marseilles were the subject of much suspicion in France at the outbreak of the war, owing to the fact that sulphur is still contraband of war and to the fact that the local managing officials were Germans. The Germans fled and the plants were

threatened with seizure by the French government; however, after some negotiations, this was averted by satisfactory representation of American ownership being made.

No report of production was obtained from the Freeport Sulphur Co., which operated the Bryan Heights property at Freeport, Tex. The company placed its second steaming plant in operation in the autumn, and at the end of the year was supposed to be producing at the rate of about 200 tons per day. There was no other production of consequence in the United States, as most of the sulphur deposits are not conveniently situated with respect to the principal markets. Some exploration took place in Texas, but most of the deposits under consideration were too far from the seaboard to compete in the general market.

Markets of the Minor Metals

Antimony

Antimony was spectacular in its antics. Practically the whole of our supply comes from foreign countries. Some of this, like the Hungarian, was completely cut off, while some, like the Chinese and Japanese, was temporarily suspended by transportation difficulties. At the beginning of 1914 common brands of antimony were worth about 6c. per lb. At the mid-year, 5¾c. At the first of August, 5½c. At the middle of August, 16 to 18c. As conditions righted themselves, the price gradually declined to 9c. in October, but then Russia, needing antimony for military purposes, bought largely in this market, which was contributory in putting the price up again to 15c. At the close of the year it is about 13@14c. This will, without doubt, lead to the reopening of antimony mines in the United States, which are unprofitable at low prices, while there is an immense deposit of antimony ore in Mexico which may be exploited if that country should become reasonably safe.

AVERAGE PRICES OF ANTIMONY

(In Cents per Pound)

	1912			1913			1914		
	Cookson's	U. S.	Ordinaries	Cookson's	U.S.	Ordinaries	Cookson's	U. S.	Ordinaries
January	7.53	7.47	6.88	9.94	9.53	8.97	7.388	7.110	6.125
February	7.27	7.44	6.83	9.47	9.09	8.25	7.250	7.057	6.100
March	7.65	7.56	6.86	9.28	8.85	8.18	7.315	7.073	6.053
April	8.05	7.75	6.94	9.13	8.50	7.98	7.363	7.048	6.006
May	8.02	7.75	7.10	8.88	8.37	7.79	7.365	7.020	5.845
June	8.09	7.78	7.21	8.79	8.27	7.64	7.250	7.000	5.825
July	8.42	7.96	7.50	8.54	8.08	7.55	7.210	6.940	5.638
August	8.59	7.98	7.70	8.38	7.91	7.39	17.250	15.800	13.800
September	9.12	8.50	8.26	8.37	7.93	7.37	11.830	.....	9.940
October	10.30	9.62	9.30	7.60	7.27	6.49	14.680	.....	12.060
November	10.39	9.86	9.30	7.62	7.30	6.45	17.750	.....	14.450
December	10.21	9.62	9.18	7.50	7.25	6.13	16.130	.....	13.310
Year	8.90	8.26	7.76	8.73	8.22	7.52	10.732	.....	8.763

The rise in the price of antimony was reflected in the price of antimony oxide, which gradually rose from 6c. in August to about 10c. at the end of 1914. The principal producer of antimony oxide is the Harshaw, Fuller & Goodwin Co., of Cleveland, Ohio. Its principal use is to reduce crazing in the manufacture of enameled ware.

Platinum

Platinum was steady at $43@45 up to August. Then it jumped to $55@60, but settled back to $50. The advance was attributable especially to fear of a suspension of supply from Russia. The export from there did cease, yet this had no great effect upon the market here, which began to decline in October and soon was back at $43@45. This was rather a surprising development, inasmuch as production in Russia had come practically to a standstill, and much distress among the miners was reported from there, to relieve which the Imperial Bank made advances of 18,000 rubles per pood of crude metal unsalable by the producers.

AVERAGE PRICES OF PLATINUM

In Dollars per Ounce Troy

	New York Refined Platinum	Russia, Crude Metal 83% Platinum	
		St. Petersburg	Ekaterinburg
January	43.38	36.43	36.28
February	43.50	36.36	36.28
March	43.50	36.39	36.28
April	43.50	36.46	36.28
May	43.50	36.41	36.28
June	43.50	36.09	36.00
July	43.50	35.72	35.72
August	50.20	.....	.....
September	50.00	.....	35.72
October	49.50	.....	33.84
November	45.45	.....	.....
December	42.19	.....	.....
Year	$45.14	.....	.....
Average for 1913	44.88	$36.54	$36.25
Average for 1912	45.55	37.08	37.05
Average for 1911	43.12	35.21	35.09
Average for 1910	32.70	26.96	26.37

The production of platinum in Russia is estimated at something between 60,000 and 80,000 ounces. The decrease was due at first to some uncertainty as to the course of the Government in permitting exports of crude metal; later to the scarcity of miners, a large number having been called into the army.

Supplies from Colombia, as usual, were rather irregular and uncertain. The production in the United States was about as usual, a few hundred ounces being obtained from gold parted and refined by the Mint, chiefly from northern California. A small quantity is also obtained from complex ores treated by the Balbach Smelting & Refining Co.

Iridium was irregular in price, owing to small supplies. At times as much as $85 or $90 per oz. was paid. It is necessary in making the hard metal used for magneto points in the automobile engine. In consequence of the high prices the differential between ordinary platinum and refined metal has advanced to from $4 to $7 per oz., according to quality.

Imports of platinum into the United States for the 10 months ended Oct. 31, 1914, were 66,544 oz., 28,496 oz. being unmanufactured and 38,048 oz. manufactured forms; in addition, chemical ware valued at $33,337 was imported. For the corresponding period in 1913 the import included 41,669 oz. crude, or unmanufactured, 59,048 oz. manufactured and $82,970 worth of chemical ware.

Cadmium

A small production of cadmium was made in the United States in 1914 by the Grasselli Chemical Co., at Cleveland, Ohio, and by the American Smelting & Refining Co., at its Globe plant at Denver, Colo. The total is probably not very different from that of 1913, which we estimated at 25,000 pounds.

During the first seven months of 1914 the price of metallic cadmium ranged from 95c. to $1.15 per lb., quotations varying according to quantity and quality. During August and September a few sales were made as high as $1.35 per lb., after which the market relapsed to the previous basis of 95c. to $1.15.

New Mine and Metallurgical Construction in 1914

Alaska Gold Mining Co., Juneau, Alaska, is completing the installation of the first 6000-ton unit of their mill.

Alaska-Treadwell, Treadwell, Alaska, added 30 stamps to its Seven-Hundred mill; 300-stamp mill was electrified, and plans made for electrifying the 240-stamp mill.

Delarof Development Co., Unga Island, Alaska, broke ground June 15 for 200-ton cyanide plant to cost $25,000, and to be completed Nov. 1. Plant to treat 400,000 tons tailings of Apollo company, now on the tide flats of Unga Bay.

Arizona Consolidated Gold Mines Co., Kingman, Ariz., broke ground June 1, 1914, for a Nissen stamp mill of 6 to 12 tons daily capacity, which was completed Aug. 1; cost of installation, $7500.

Copper Queen Consolidated Mining Co., Bisbee, Ariz., broke ground Feb. 4 for a test concentrating mill, of 50 tons daily capacity, which cost $40,000, and was scheduled for completion June 1, 1914.

Hermitage Mining & Milling Co., Hereford, Ariz., has completed a two-jig concentrator of 30 tons daily capacity, at a cost of $11,000.

International Smelting & Refining Co., Miami, Ariz., broke ground in December for a copper smelter, which will have capacity for producing 100,000,000 lb. of copper annually. The cost will be $2,000,000, and the plant will consist of four reverberatory furnaces, blast furnace and converters.

Kelvin-Sultana Copper Co., Kelvin, Ariz., built a concentrator of 100 tons daily capacity, to cost $50,000, completed about June 1, 1914.

Pasquale Copper Co., Bellevue, Ariz., broke ground May 1, for a 100-ton flotation plant, which will cost $35,000 and be completed in six months.

R. F. Schaefer, Vulture, Ariz., will build a mill with three to five stamps.

Twin Peaks Mining & Milling Co., York, Ariz., built a concentrator and cyanide plant of 50 tons daily capacity. It was scheduled to be completed Mar. 1, 1914.

Argonaut Mining Co., Jackson, Calif., expects to remove 40-stamp mill to a new site and increase to 50 stamps.

Ash Creek Mining Co., Hornbrook, Calif., broke ground July 1 for a six-stamp mill with capacity of 18 tons, to cost $6000 and to be completed about Dec. 1.

Bishop Creek Milling Co., Bishop, Calif., broke ground Apr. 1 for a $25,000, 10-stamp mill and cyanide plant of 50 tons daily capacity. Completed about July 1, 1914.

Brunswick Consolidated Gold Mining Co., Grass Valley, Calif., is planning to build a mill of 50 tons daily capacity at a cost of $20,000.

California Exploration Co., Ltd., Plymouth, Calif., built an amalgamation and concentration mill of 300 tons daily capacity.

Conzetti Mine, Cecilville, Calif.—Claims bonded to L. E. Spear under agreement to install a 10-ton mill unit every six months until capacity of 100 tons is obtained.

Empire Mines & Investment Co., Grass Valley, Calif., broke ground May 15 for a mill of 240 tons daily capacity, which, it was estimated, would cost $75,000, and be completed by Jan. 1, 1915.

Engels Copper Mining Co., Taylorsville, Calif., broke ground, June 1, for 250-ton Minerals-Separation flotation mill, capable of being extended to 400 tons by small additions to apparatus. Plant was to cost $40,000, and was to be completed Nov. 1, 1914.

Excelsior Gold Mines Co., Forest Hill, Calif., is building a stamp mill of 200 tons daily capacity.

Keane Wonder Mining Co., Keane Wonder, Calif., broke ground in December for a crushing (three sets of rolls) and cyaniding plant of from 300 to 500 tons daily capacity; estimated cost $50,000 and scheduled date of completion, June 1, 1914.

Melones Mining Co., Melones, Calif., broke ground, Aug. 1 for 250-ton cyanide sand-leaching plant to cost $10,000 to $12,000, and to be completed Oct. 1, 1914.

Midas Gold Mining Co., Knob, Shasta County, Calif., is building an all-sliming cyanide plant for stored and current tailings, of 100 tons daily capacity, at a cost of $30,000. Ground was broken in June, 1913, and the plant was to be completed in December, 1914.

Mountain Copper Co., Keswick, Calif., is building a flotation concentrator, for copper ore, of 250 tons capacity.

Mountain King Mining Co., Mountain King, Calif., broke ground Oct. 6 for a 150-ton 30-stamp concentrating plant, to cost $50,000 and to be completed in January, 1915.

R. P. Newcomb, Oat Hill mine, Middletown, Calif., completed a concentration plant for cinnabar ore.

Phœnix Cyanide Co., Johannesburg, Calif., completed Nov. 26 a 15- to 25-ton agitation and cyanide plant, costing $2500.

Royal Consolidated Gold Mines, Copperopolis, Calif., contemplated overhauling old 120-stamp mill and installing new machinery.

Sierra-Alaska Mining Co., Pike, Calif., is building experimental cyanide plant, 10-tons capacity, to be enlarged if process is successful.

St. Francis Gold Mining Co., Moretown, Calif., broke ground Mar. 1, for a 5-stamp mill of 16 to 20 tons daily capacity, which cost $3000.

Tulare Mining Co., Porterville, Calif., contemplates installing machinery to manufacture epsom salts from magnesite waste.

Arnold Concentrating Machinery Co., Lawson, Clear Creek County, Colo., broke ground Mar. 25, 1914, for a concentrator for treating low-grade ores, which cost $10,000 and was completed May 25.

Cariman Mining & Milling Co., Caribou, Colo., broke ground in July for 150-ton concentrating and cyanide plant to cost $6000. To be completed Nov. 1, 1914.

Dorit Mining, Milling, Tunnel & Transportation Co., Idaho Springs, Colo., was to break ground Apr. 15 for an amalgamation and concentration works of 50 tons daily capacity, to cost $25,000, and to be completed Aug. 1; a cyanide plant is to be built later.

El Oro Mining & Milling Co., Elkton, Colo., is building a combination milling plant of 300 tons daily capacity, which will cost $100,000.

Hector Mines Development Co., Westcliffe, Colo., broke ground Aug. 10, for 50-ton cyanide plant to cost $40,000.

Mineral Hill Ore Reduction & Leasing Co., Cripple Creek, Colo., was to break ground May 15, for a cyanide plant of 100 tons daily capacity, which was estimated to cost $30,000 and be completed by Aug. 1.

Mountain Top Mining Co., Ouray, Colo., expects to build a mill.

Standard Chemical Co., Naturita, Colo., completed Nov. 25 a 30-ton concentrating mill, costing $100,000.

Tomboy Gold Mines Co., Ltd., Telluride, Colo., broke ground May 7, 1914, for a cyanide plant of 400 tons daily capacity for the treatment of tailings, which cost $140,000 and was completed Dec. 1.

United Zinc & Lead Co., Leadville, Colo., broke ground May 15, for a zinc oxide plant of 50 tons daily capacity at the start and which was completed in August.

Vindicator Consolidated Gold Mining Co., Independence, Colo., broke ground Dec. 1, 1913, for a screening plant of 200 tons daily capacity, which cost $20,000.

Vindicator Consolidated Gold Mining Co., Independence, Colo., completed Oct. 15 a 500-ton concentrating mill, costing $40,000.

Wanakah Mining Co., Ouray, Colo., broke ground May 1 for a 200-ton copper matting furnace additional to 100-ton plant already in operation. To cost $50,000, and to be completed Oct. 20.

Western Zinc Mining & Reducing Co., Leadville, Colo., broke ground, Mar. 23, for a zinc-oxide plant of 50 tons daily capacity, which it was expected would be completed by Aug. 1.

Virginia Consolidated Gold Mining Co., Sandy Creek, Lemhi County, Idaho, broke ground in May for an amalgamation and concentration mill of 20 tons daily capacity, to cost $25,000, which was to be completed in October. The mill is driven by water power.

Anne Lee Mining Co., Spring City, Mo., broke ground Dec. 10, 1913, for a zinc, lead and silicate concentrator of 250 tons capacity per 10 hr., which cost $50,000 and was completed Apr. 20, 1914.

Cumberland Mining & Milling Co., Joplin, Mo., broke ground July 15 for 350-ton concentrating plant to cost $25,000, and was to be completed Oct. 5.

Schoolhouse Mining Co., North Carterville, Mo., broke ground Jan. 20 for a zinc concentrator of 800 tons daily capacity, which cost $20,000 and was completed Apr. 10, 1914.

Tecumseh Mining Co., Thoms Station, Mo., operated by Homer Seals, Joplin, Mo., is building a mill of 150 tons' daily capacity, which will cost $10,000.

White Pine Copper Co., Ontonagon, Mich., broke ground Apr. 15, for a stamp mill of 1000 tons daily capacity, which, it is estimated, will be completed by May 1, 1915.

Cleveland-Cliffs Iron Co., Nashwauk, Minn., expected to break ground Mar. 15, 1914, for a washing plant to treat Mesabi sandy ores, of 2000 tons of concentrates daily capacity.

Anaconda Copper Mining Co., Anaconda, Mont., is building, at the Washoe Reduction Works, a leaching plant of 2000 tons daily capacity, to cost $900,000, and a sulphuric-acid plant of 100 tons daily capacity, to cost $350,000.

Barnes King Development Co., Marysville, Mont., is building a cyanide plant of 100 tons daily capacity, all orders for machinery and equipment having been placed.

Butte Duluth Mining Co., Butte, Mont., is building a mill for treating 1000 tons of ore per day, which will cost $130,000.

Butte Duluth Mining Co., Butte, Mont., broke ground Nov. 1, 1913, for a leaching plant with electrolytic precipitation of 1000 tons' capacity, which cost $250,000 and was completed in July.

King & Queen Mining Co., Keystone, Mont., is building a lead-silver ore concentrator of 125 tons daily capacity, at an estimated cost of $20,000.

Northwestern Metals Co., Helena, Mont., is operating a dry chlorination zinc works of 100 tons daily capacity, which cost $375,000.

Poryphyry Dike Gold Mining Co., Rimini, Mont., broke ground June 25 for 100-ton stamp mill with amalgamating plates, to cost $40,000, and to be completed Sept. 15, 1914.

Timber Butte Milling Co., Butte, Mont., has completed a zinc-ore concentrator of 350 to 400 tons daily capacity, at a cost of $600,000.

Aurora Con. Mining Co., Aurora, Nev., completed construction of its 500-ton all-sliming cyanide mill. Now running.

Boss Gold Mining Co., Goodsprings, Nev., built a cyanide test plant of 25 tons daily capacity this summer.

Bluster, Elko, Nev., is building a small mill, duplicate of that of the Elko Mining Co.

Carrara Mining & Milling Leasing Syndicate, Carrara, Nev., broke ground Dec. 20, 1913, for a $5000 mill, containing three 15-ton chilean mills, scheduled to be completed Feb. 20, 1914.

Commercial Mines & Milling Co. of Manhattan, Manhattan, Nev., made an addition to the old mill, to bring it up to a capacity of 200 tons per day.

Eastern Star Mining Co., Midas, Nev., expected to break ground Nov. 1 for 50-ton all-slime cyanide plant.

Elko Mining Co., Jarbidge, Nev., built a cyanide plant last summer.

Irwin Bros., Current, Nye County, Nev., completed a small stamp mill of 10 to 15 tons' daily capacity, May 1, 1914; it cost $2000.

Legitimate Mines Co., Jarbidge, Nev., is drawing up plans for a small mill.

Metals Recovery Co., Dayton, Nev., has completed a cyanide plant of 200 tons daily capacity, which cost $50,000.

Nevada-Douglas Copper Co., Ludwig, Nev., broke ground Aug. 1914, for 250-ton copper-leaching plant to cost $125,000 and to be completed in January, 1915.

Nevada Packard Mines Co., Rochester, Nev., began grading Oct. 1, for the first 50-ton unit of a cyanide plant.

O'Kelly & Munzberg, Goodsprings, Nev., contemplate erecting a milling plant at the Frederickson property.

Pittsburg-Dolores Mining Co., Rockland via Yerington, Nev., broke ground June 1 for an 80-ton cyanide mill to cost $40,000, to be completed Apr. 1, 1915.

Rochester Consolidated Mining & Milling Co., Rochester, Nev., broke ground Aug. 1, for 100-ton all-slime cyanide plant, using the Dow system, to cost about $100,000, and to be completed Feb. 1, 1915.

Sunset Mining & Development Co., Rhyolite, Nev., is building a stamp mill and cyanide plant of 2000 tons monthly capacity.

George Threlfall, Candelaria, via Mina, Nev., is planning to build a mill of 25 tons daily capacity.

Tonopah Belmont Development Co., Tonopah, Nev., is remodeling the old mill at Millers, operating at half capacity meanwhile.

Tonopah Extension Mining Co., Tonopah, Nev., added 10 stamps to its 30-stamp mill. Addition now running.

Tonopah Mining Co., Millers, Nev., changed its Desert mill from 500-ton double-treatment plant to a 400-ton all-slime mill.

Union Mines Co., Union, via Palisades, Nev., broke ground June 24 for 50- to 100-ton concentrating plant to cost $125,000, and to be completed June 1, 1915.

West End Con. Mining Co., Tonopah, Nev., added 10 stamps and a tube mill to its plant. Addition now running.

Wagner Azurite Copper Co., Luning, Nev., has completed a 100-ton leaching plant for copper ore, the first of several units, which will be built later if the first gives satisfaction.

West End Consolidated Mining Co., Tonopah, Nev., broke ground Nov. 15, 1913, for a 10-stamp addition to its 20-stamp mill, increasing the capacity by 50 tons daily. Addition cost $30,000. Completed Mar. 10, 1914. Mill capacity, 220 tons per day.

Winnemucca Milling & Ore Purchasing Co., Winnemucca, Nev., is about to begin building a 35-ton mill and sampling plant for custom work.

International Smelting Co., Perth Amboy, N. J., is enlarging Raritan refinery from 35,000,000 to 40,000,000 lb. monthly capacity.

Northern Ore Co., Edwards, N. Y., broke ground Oct. 1 for a 50- to 100-ton concentrating mill, to be completed Dec. 1, 1914.

Cossak Mining Co., Bland, N. M., broke ground Jan. 1 for an all-sliming cyanide plant of 100 tons daily capacity, to cost $75,000.

Hill City M. & D. Co., Hill City, S. D., purchased hoisting machinery for its 100-ft. shaft.

Homestake Mining Co., Lead, S. D., is building a boiler plant containing six 600-hp. boilers to drive new hoisting engine at B. & M. shaft, and an electric-generating plant.

Mogul Mining Co., Deadwood, S. D., completed new 150-ton mill near Terry, S. D.

Rattlesnake Jack, Galena, S. D., is building a cyanide plant containing stamps, Trent cyaniding machinery and Merrill precipitation.

Titanic, Carbonate, S. D., proposes to build a cyanide mill.

Dome Mines Co., Porcupine, Ont., changed treatment system, added 40 stamps and leaching tanks to the mill.

Hollinger, Timmins, Ont., increased the mill installation and rearranged treatment system.

McIntyre, Porcupine, Ont., is installing a counter-current decantation system for handling slimes tailings. It will soon be in operation.

Schumacher Gold Mines, Ltd., Schumacher, Ont., expects to break ground in April, 1915, for a 100-ton cyanide plant.

Tough-Oakes Gold Mines, Ltd., Kirkland Lake, Ont., is building 100- to 125-ton cyanide plant.

Vipond, Schumacher, Ont., built a cyanide plant to treat ore from its mine which had previously been treated by amlagamation.

Church-Mabon Mining Co., Miami, Okla., is building a lead and zinc mill of 200 tons daily capacity and which will cost $25,000. Ground was broken Dec. 1, 1913, and mill was to be completed Mar. 1, 1914.

Lennan Zinc & Lead Co., Miami, Okla., began the erection of a new concentrator in April.

Ben Harrison Mine, Whitney, Ore., expected to break ground in July for a cyanide plant of 120 tons' daily capacity to cost $40,000 and be completed by October.

Golden Gate Mining Co., Greenhorn, Ore., broke ground July 1 for a 35-ton amalgamating plant, to cost $45,000, and to be completed about Jan. 1, 1915.

Good Hope Mining Co., Keystone, S. D., broke ground Oct. 1 for a 10-stamp mill with a capacity of 40 tons, to cost $10,000 and to be completed Jan. 1, 1915.

Aluminum Co. of America, Maryville, Tenn., broke ground for a reduction plant July 1, 1913, which was completed in March.

Park City Milling Co., Park City, Utah, began remodeling the Grasselli mill Mar. 17, 1914, for treating 50 tons of ore daily, by chlorination, the cost being $21,000; the work was completed early in July.

Utah Minerals Concentrating Co., Eureka, Utah, completed in November a 100-ton centrifugal concentrating plant, to treat Chief Consolidated ores.

Hammond Mining Co., Glacier, Wash., is reconstructing an old milling plant and adding modern cyanide equipment.

Chewelah Copper King Mining Co., Chewelah, Wash., is building a smelter of 100 tons daily capacity, which will cost $50,000.

Metaline Oriole Mining Co., Metaline, Wash., broke ground Oct. 1, 1913, for a concentrator of 50 tons daily capacity, to cost $5000, and which was scheduled for completion June 1, 1914.

Field Mining & Milling Co., New Diggings, Wis., broke ground in December for a 450-ton zinc concentrating mill to cost $30,000 and was to be completed in April, 1915.

Lawrence Mines Co., Hazel Green, Wis., completed entire mining equipment and mill of 150 tons' capacity per 9-hr. shift.

Mineral Point Zinc Co., New Diggings, Wis., will soon complete, a Joplin-type mill of 250 tons' daily capacity at a cost of $12,000.

Wisconsin Zinc Co., New Diggings, Wis., broke ground May 1, 1914, for a hoisting plant and mill of 300 tons capacity per 24 hr., at a cost of $50,000; completed in September.

Western Wyoming Mining & Milling Co., Cokeville, Wyo., expected to break ground May 1, for a 50 to 75 tons daily capacity treatment plant, to cost $20,000.

Aguacate Mines, San Mateo, Costa Rica, has completed a cyanide plant of 3000 tons annual capacity.

Broken Hill, Lillooet, B. C., is building a large concentrator.

Braden Copper Co., Rancagua, Chile, is figuring on completing its works of 10,000 tons daily capacity, which will cost $7,000,000, in two and a half years.

Chontalpan y Anexas, Tetepac, Guerrero, Mexico, is reported to have ordered five additional stamps for the mill.

Escorpion Mine, Hostotipaquillo, Jalisco, Mexico, is reported to be planning a 10-stamp mill and cyanide plant.

Mutual Mining & Milling Co., Mexico City, is reported to be building a concentrator.

Mt. Morgan Gold Mining Co., Mt. Morgan, Queensland, Australia, is building a concentrator and smelter of 400,000 tons annual capacity, shops and power plant, at a cost of $1,600,000.

Aluminum

The aluminum business in 1914 exhibited but few points of interest. During the last quarter of 1913 the consumption of aluminum decreased largely, in common with the reduction of business activity in other lines throughout the United States. The demand for aluminum during 1914 was practically the same as it was during the last quarter of 1913, i.e., small in volume and listless in character. There was a little spurt during March, but it proved to be short-lived, and with the exception of this little show of activity, the market for 15 months has been slow and substantially less than during the first nine months of 1913.

AVERAGE MONTHLY PRICE OF INGOT ALUMINUM
(At New York, in cents per pound).

Year	1911	1912	1913	1914	Year	1911	1912	1913	1914
Jan.	20.13	19.13	26.31	18.81	July	20.20	23.50	23.38	17.66
Feb.	21.25	19.44	26.04	18.81	Aug.	20.02	24.38	22.70	19.88
Mar.	21.15	19.58	27.05	18.50	Sept.	19.34	25.13	21.69	19.94
April	20.75	20.38	27.03	18.16	Oct.	18.75	26.25	20.13	18.50
May	20.55	21.69	26.44	17.95	Nov.	18.79	26.56	19.35	18.00
June	20.03	22.83	24.68	17.75	Dec.	18.85	25.75	18.88	18.96
					Year	20.067	22.01	23.64	18.63

The foil mill of the Aluminum Co. of America was started in the spring of 1914 and has developed a successful and substantial business, although at best the tonnage of foil consumption in this country is not large. The product of this mill is taking the place partly of aluminum foil which was formerly imported and partly of tin foil and is used for wrapping tea, chocolate, tobacco and other such commodities.

The Aluminum Co. of America also started in 1914 its plant at Maryville, Tenn., which, however, is a small plant and has not added substantially to the output of the United States.

WORLD'S PRODUCTION OF ALUMINUM
(Metric Tons)
(From statistical report of the Metallgesellschaft, Frankfurt am Main)

	1911	1912	1913
United States	18,000	19,500	22,500
Canada (exports)	2,300	8,300	5,900
Germany, Austria-Hungary, Switzerland	8,000	12,000	12,000
France	10,000	13,000	18,000
England	5,000	7,500	7,500
Italy	800	800	800
Norway	900	1,500	1,500
Totals	45,000	62,600	68,200

With the above exceptions, the Aluminum Co. of America and its interests did not do anything new in 1914, but it is getting ready to start next spring on an important plant at Edgewater, N. J., the land for which has been purchased and the plans for the buildings and machinery of which are now being made. The Edgewater plant will be a sheet mill and stamping factory, making sheet for the trade, cooking utensils and other finished goods.

WORLD'S CONSUMPTION OF ALUMINUM
(Metric Tons)
(From statistical report of the Metallgesellschaft, Frankfurt am Main)

	1911	1912	1913
United States *a*	20,900	29,800	32,800
France	5,000	6,000	7,000
England	3,000	4,000	5,000
Italy	900	1,000	1,000
Other countries	17,000	22,100	21,000
Totals	46,800	62,900	66,800

a U. S. Geological Survey.

The Southern Aluminum Co. continued its construction at Whitney, N. C., up to the outbreak of the war, when it found itself embarrassed by the financial tempests of the time and was obliged to suspend operations. Probably the affairs of this company will be adjusted before long and construction will be resumed.

The Aluminum Co. of America continues to be, therefore, the only producer of virgin aluminum in the United States, the remaining production being by concerns that resmelt scrap and junk. The imports of aluminum into the United States during the first 10 months of 1914 were 14,398,031 lb., compared with 20,775,103 lb. in the corresponding period of 1913.

Tungsten

During the first seven months of 1914 the production of tungsten ore was practically at a standstill, inasmuch as the steel works using the products therefrom—ferrotungsten, etc.—were doing the smallest business on record. Quotations for ore were merely nominal. In fact, for several months there was no production.

After the outbreak of the war the situation improved somewhat, but the use of tungsten products is not yet up to 50% of the normal. The principal orders came from foreign countries that were cut off from the German supply of finished products. This business was done only for immediate shipment and, necessarily, was done at a relatively high price, inasmuch as only such ores could be considered as were actually on hand. During the first seven months of 1914, tungsten prices averaged, probably, about 67c. per lb. Since the war, lots for immediate shipment have been sold as high as $1.35 per lb.

Mining Dividends in 1914

The tables which follow show the dividends paid in 1913, 1914 and to date by the principal mining, metallurgical and holding companies of America. The list includes practically all United States mining companies paying dividends since 1906, except a few which have ceased to have a separate corporate existence.

For the first time in several years the figures show a shrinkage in dividends paid. In 1913 there were 110 mining companies paid $73,440,701; in 1914 there were 90 companies paid $55,563,732. In neither year are the figures absolute, nor can they be. Certain corporations, and those not the least profitable, such as the New Jersey Zinc Co., will make no public report of their dividends. In others, such as Nevada Consolidated and Utah Copper, there is a duplication.

Nor can the dividends of metallurgical and holding companies simply be added to those of the mining companies as a gage of prosperity. The dividends of the Guggenheim Exploration Co. are almost entirely a duplication of the dividends of mining companies whose stocks are owned by the big corporation. However, on a comparative basis, these companies paid $99,740,693 in 1913; $91,782,505 in 1914.

Owing to the fact that most mines produce two or more commercial metals we have attempted no hard and fast distribution of companies into copper producers, lead producers, etc. One lonely quicksilver mine, New Idria, is in the list.

The Canadian list of mines is believed complete. The Mexican mines given are chiefly those in which American capital is interested. Of the Canadian, Mexican and Central American corporations listed, 51 paid $21,654,260 in 1913; 40 paid $15,058,220 in 1914.

These shrinkages need no apologies: The Great War; revolution in Mexico; and the last day of the Michigan strike are enough to explain them.

DIVIDENDS OF MINING COMPANIES IN THE UNITED STATES

COMPANY NAME	SITUATION	SHARES Issued	SHARES Par Value	DIVIDENDS PAID 1913 Per Share	1913 Total	1914 Per Share	1914 Total	To Date Total	Latest Date	Latest Amount
Acacia, g	Colo.	1,438,989	$ 1	....	.....	....	.....	$122,004	Jan. '11	$0.00½
Adams, s.l.c.	Colo.	80,000	10	....	.....	....	.....	778,000	Dec. '09	0.04
Ahmeek, c.	Mich.	50,000	25	22.00	1,100,000	6.00	300,000	2,400,000	July '14	2.00
Alaska Goldfields	Alas.	250,000	5	....	.....	....	.....	342,500	Jan. '10	0.15
Alaska Mexican, g.	Alas.	180,000	5	1.00	180,000	0.80	144,000	3,417,381	Nov. '14	0.20
Alaska Treadwell, g.	Alas.	200,000	25	5.00	1,000,000	5.50	1,100,000	14,885,000	Nov. '14	1.00
Alaska United, g.	Alas.	180,200	5	2.30	414,460	0.90	162,080	1,738,930	Nov. '14	0.20
Am. Zinc, Lead & Sm.	Kan.	167,200	25	1.00	172,420	0.50	85,600	983,320	Jan. '14	0.50
Anaconda, c.	Mont.	4,662,500	25	3.00	12,997,500	2.50	11,161,250	92,579,375	Oct. '14	0.25
Argonaut, g.	Calif.	200,000	5	....	.....	1.80	360,000	1,560,000	Dec. '14	0.10
Arizona Copper, pf.	Ariz.	1,266,120	1.20	*a*	119,221	*a*	119,221	2,009,744	Nov. '14	.....
Arizona Copper, com.	Ariz.	1,519,896	1.20	*b*	1,292,669	0.24	831,003	16,815,497	July '14	0.24
Bagdad-Chase, g., pf.	Calif.	84,819	5	....	.....	....	.....	202,394	Jan. '09	0.10
Bald Butte, g.s.	Mont.	250,000	1	....	.....	....	.....	1,344,648	Oct. '07	0.04
Baltic, c.	Mich.	100,000	25	2.00	200,000	....	.....	7,950,000	Dec. '13	2.00
Beck Tunnel, g.s.l.	Utah	1,000,000	0.10	....	.....	....	.....	940,000	Oct. '09	0.02
Benton, z.l.	Wis.	196,607	1	....	.....	....	.....	10,949	Oct. '08	0.01½
Bingham-New Haven, c.	Utah	228,690	5	0.20	45,738	0.20	45,738	385,695	Apr. '14	0.20
Board of Trade, z.	Wis.	120,000	1	....	.....	....	.....	78,000	Jan. '11	0.05
Bonanza Dev., g.	Colo.	300,000	1	....	.....	....	.....	1,425,000	Oct. '11	0.20
Boss, g.	Nev.	408,500	1	....	.....	0.10	40,850	40,850	Dec. '14	0.10
Boston-Sunshine, g.	Utah	150,200	1	....	.....	....	.....	27,261	Nov. '11	0.03½
Brunswick, g.	Calif.	395,284	1	0.06	23,717	0.18	94,869	130,444	Nov. '14	0.06
Bull, Beck & Champ., g.	Utah	100,000	10	....	.....	....	.....	2,728,400	July '08	0.10
Butte-Alex. Scott, c.	Mont.	74,000	10	1.00	74,000	....	.....	148,000	Oct. '13	0.50
Bunker Hill Con., g.	Calif.	200,000	1	0.62½	125,000	0.30	60,000	761,000	Dec. '14	0.02½
Bunker Hill & Sull., l.s.	Ida.	327,000	10	2.50	817,500	3.00	981,000	15,710,250	Dec. '14	0.25
Butte & Ballaklava, c.	Mont.	250,000	10	....	.....	....	.....	125,000	Aug. '10	0.50
Butte & Superior, z.	Mont.	271,136	5	....	.....	2.25	610,054	610,054	Dec. '14	0.75
Caledonia, l.s.	Ida.	2,605,000	1	....	.....	0.05	130,250	182,350	Dec. '14	0.01
Calumet & Arizona, c.	Ariz.	617,385	10	5.00	3,059,209	3.00	1,850,475	20,941,524	Dec. '14	0.50
Calumet & Hecla, c.	Mich.	100,000	25	32.00	3,200,000	10.00	1,000,000	124,250,000	June '14	5.00
Camp Bird, g.s.	Colo.	1,100,051	4.86	0.24	267,312	....	.....	9,483,524	Jan. '13	0.24
Camp Bird, pfd., g.	Colo.	650,000	4.86	0.34	221,130	0.34	221,130	724,020	July '14	0.17
Centennial-Eur., l.s.g.c.	Utah	100,000	5	3.00	300,000	1.50	150,000	4,050,000	Apr. '14	1.50
Center Creek, l.z.	Mo.	100,000	10	0.30	30,000	0.20	20,000	510,000	Oct. '14	0.05
Champion, c.	Mich.	100,000	25	9.00	900,000	....	.....	8,400,000	Oct. '13	1.00
Chief Con., s.g.l.	Utah.	871,384	1	0.20	175,308	0.10	87,662	262,970	Aug. '14	0.05
Chino, c.	Ariz.	777,458	5	2.25	1,919,070	2.50	2,162,050	4,081,120	Dec. '14	0.50
Cliff, g.	Alas.	100,000	1	0.25	25,000	....	.....	210,000	Dec. '13	0.05
Cliff, s.l.	Utah	300,000	1	0.10	30,000	....	.....	90,000	Jan. '13	0.10
Colo. Gold Dredging	Colc.	100,000	10	1.00	100,000	3.50	350,000	650,000	Sept. '14	1.00
Colorado, l.s.g.	Utah	1,000,000	...	....	.....	....	.....	2,570,000	Dec. '12	0.03
Columbus Con., l.g.s.	Utah	285,540	5	....	.....	....	.....	226,832	Oct. '07	0.20
Commercial Gold	Ore.	1,750,000	1	....	.....	....	.....	43,750	Dec. '09	0.00½
Comstock Phoenix, s.	Nev.	800,000	1	....	.....	....	.....	40,000	Nov. '11	0.05
Con. Mercur., g.	Utah	1,000,000	1	0.30	30,000	....	.....	3,445,313	July '13	0.03
Continental, z.l.	Mo.	22,000	25	1.00	22,000	1.00	22,000	319,000	July '14	0.03
Copper Range Con., c.	Mich.	393,714	100	2.75	1,084,490	....	.....	13,986,746	Oct. '13	0.50
Daly-Judge, s.l.	Utah	300,000	1	0.60	180,000	0.60	180,000	855,000	Dec. '14	0.15
Daly West, s.l.	Utah	180,000	20	0.15	27,000	....	.....	6,606,000	Jan. '13	0.15
De Lamar, g.s.	Ida.	80,000	5	....	.....	....	.....	875,000	Aug. '11	0.25
Dr. Jack Pot Com., g.	Colo.	3,000,000	0.10	....	.....	....	.....	45,000	Mar. '11	0.00½
Doe Run, l.	Mo.	65,782	100	5.00	328,844	....	.....	3,550,969	Dec. '13	0.75
Dunkin, g.	Colo.	200,000	1	0.05	10,000	....	.....	10,000	Oct. '13	0.05
Elkton Con., g.	Colo.	2,500,000	1	0.08	200,000	0.08	200,000	3,479,000	Nov. '14	0.02
El Paso, g.	Colo.	490,000	5	0.12½	61,250	0.10	49,000	1,707,545	Feb. '14	0.10
Eagle & Blue Bell, g.s.l.	Utah	893,146	1	0.20	178,629	0.15	133,972	304,601	Oct. '14	0.05
Ernestine, g.s.	N. M.	300,000	5	....	.....	....	.....	120,000	Dec. '12	0.05
Federal M. & Sm., com.	Ida.	60,000	100	....	.....	....	.....	2,708,750	Jan. '09	1.50
Federal M. & Sm., pf.	Ida.	120,000	100	6.00	749,131	5.00	599,305	8,986,948	Dec. '14	1.00
Florence, g.	Nev.	1,050,000	1	....	.....	....	.....	840,000	Apr. '11	0.10
Frances Mohawk, g.	Nev.	912,000	1	....	.....	....	.....	546,000	Jan. '08	0.05
Free Coinage, g.	Colo.	10,000	100	....	.....	....	.....	180,000	Dec. '09	1.00
Fremont Con., g.	Calif.	200,000	2.50	0.24	48,000	0.20	40,000	250,000	Oct. '14	0.02
Frontier, z.	Wis.	1,250	100	....	.....	....	.....	146,202	Nov. '12	2.00
Gemini-Keystone, g.s.	Utah	5,000	100	20.00	100,000	15.00	75,000	2,305,000	Dec. '14	5.00
Gold Coin of Victor, g.	Colo.	1,000,000	1	....	.....	....	.....	1,350,000	Feb. '09	0.02
Gold Dollar Con., g.	Colo.	2,500,000	1	....	.....	....	.....	100,000	Dec. '12	0.00½
Gold King Con., g.	Colo.	5,750,370	1	....	.....	....	.....	1,407,319	Dec. '11	0.03
Gold Sovereign	Colo.	1,800,000	1	....	.....	....	.....	31,571	Nov. '12	0.00½
Golden Cycle, g.	Colo.	1,500,000	1	0.27	405,000	0.55	825,000	3,420,000	Dec. '14	0.20
Gold Chain, g.	Utah	1,000,000	....	0.06	60,000	....	.....	130,000	May '13	0.03

DIVIDENDS OF MINING COMPANIES IN THE UNITED STATES—Continued

COMPANY NAME	SITUATION	SHARES Issued	Par Value	DIVIDENDS PAID 1913 Per Share	1913 Total	1914 Per Share	1914 Total	To Date Total	Latest Date	Latest Amount
Goldfield Alamo, s.l.	Nev.	700,000	$1	....	.....	....	.....	$42,000	May '10	$0.03
Goldfield Comb. Fra., g.	Nev.	922,000	1	....	.....	....	.....	92,111	Nov. '09	0.10
Goldfield Con., g.	Nev.	3,558,367	10	0.70	1,491,403	0.30	1,067,744	27,398,214	Apr. '14	0.30
Grand Central, g.	Utah	500,000	1	0.15	75,000	0.15	75,000	1,620,750	Sept. '14	0.05
Granite, g.	Colo.	1,650,000	1	....	.....	....	.....	270,000	Nov. '12	0.01
Hazel, g.	Calif.	900,000	1	0.12	108,000	....	.....	971,000	Dec. '13	0.01
Hecla, l.s.	Ida.	1,000,000	0.25	0.32	320,000	0.22	220,000	3,190,000	Dec. '14	0.01
Hercules, l.s.	Ida.	1,000,000	1	1.50	1,500,000	....	.....	5,500,000	.... '13	.....
Homestake, g.	S. D.	250,000	100	7.80*d*	5,422,326	7.80	2,210,208	36,482,174	Dec. '14	1.65
Horn Silver, s.c.z.l.	Utah	400,000	25	....	.....	....	.....	5,642,000	Sept. '07	0.05
Insurgent, g.	Wash.	100,000	1	....	.....	....	.....	25,000	Dec. '11	0.12½
Iowa-Tiger, g.s.l.	Colo.	3,000	1	1.00	3,250	2.00	6,000	9,250	Dec. '14	1.00
Iowa, g.s.l.	Colo.	1,666,667	1	0.01	16,667	0.00½	8,333	233,499	Aug. '14	0.00½
Iron Blossom, s.l.g.	Utah	1,000,000	0.10	0.40	400,000	0.40	400,000	2,170,000	Oct. '14	0.10
Iron Silver, s.l.g.	Colo.	500,000	20	0.40	200,000	0.20	100,000	4,950,000	Dec. '14	0.10
Isle Royale, c.	Mich.	150,000	25	1.00	150,000	....	.....	150,000	Mar. '13	1.00
Jamison, g.	Calif.	390,000	10	....	.....	....	.....	378,300	Jan. '11	0.02
Jerry Johnson, g.	Colo.	2,500,000	0.10	....	.....	0.00½	12,500	187,500	Nov. '14	0.00½
Jumbo Ext., g.s.	Nev.	971,657	1	....	.....	0.05	48,583	145,750	Dec. '14	0.05
Kendall, g.	Mont.	500,000	5	....	.....	0.06	30,000	1,505,000	July '14	0.06
Kennedy, g.	Calif.	100,000	100	....	.....	....	.....	1,831,000	Apr. '10	0.03
King of Arizona, g.	Ariz.	200,000	1	....	.....	....	.....	396,000	Aug. '09	0.12
Klar-Piquette, z.l.	Wis.	20,000	1	1.25	25,000	....	.....	259,000	Apr. '13	0.50
Kennecott, c.	Alas.	250,000	10	4.00	1,000,000	4.00	1,000,000	5,000,000	Jan. '14	4.00
Knob Hill, g.	Wash.	1,000,000	3	0.02½	25,000	....	.....	70,000	Oct. '13	0.00½
Liberty Bell, g.	Colo.	130,551	5	0.80	106,891	....	.....	1,559,179	Sept. '13	.....
Little Bell, l.s.	Utah	300,000	1	....	.....	....	.....	75,000	Mar. '11	0.05
Little Florence, g.	Nev.	1,000,000	1	....	.....	....	.....	430,000	Jan. '08	0.03
Mammoth, g.s.c.	Utah	400,000	25	0.05	20,000	....	.....	2,300,000	July '13	0.05
Manhattan-Big Four, g.	Nev.	762,000	1	....	.....	....	.....	30,480	Aug. '11	0.02
Mary McKinney, g.	Colo.	1,309,252	1	0.08	104,740	0.06	78,555	1,169,307	July '14	0.02
May Day, g.s.l.	Utah	800,000	0.25	0.03	24,000	0.03	24,000	156,000	Oct. '14	0.03
Mexican, s.	Nev.	201,600	2.50	....	.....	0.75	141,750	161,910	June '14	0.75
Miami, c.	Ariz.	746,759	5	2.00	1,491,979	1.50	1,120,138	3,712,239	Aug. '14	0.50
Mohawk Min. Co., c.	Mich.	100,000	25	5.00	500,000	1.00	100,000	3,275,000	Aug. '14	1.00
Monarch-Madonna, g.s.l.	Colo.	1,000,000	1	....	.....	....	.....	40,000	May '11	0.01
Montana-Tonopah, s.g.	Nev.	921,865	1	....	.....	....	.....	488,588	Dec. '12	0.10
Moscow M. & M., g.s.c.z.	Utah	900,000	1	0.03	24,528	0.03	27,000	67,480	Dec. '14	0.03
Modoc, g.s.	Colo.	500,000	1	....	.....	....	.....	275,000	Dec. '11	0.01
Mountain, g.s.	Calif.	250,000	25	....	.....	....	.....	4,216,250	May '08	0.44
Napa Con., q.	Calif.	100,000	7	....	.....	....	.....	1,840,000	July '11	0.40
National, g.	Nev.	750,000	1	....	.....	....	.....	570,000	May '11	0.10
Nevada Con., c.	Nev.	1,999,457	5	2.00	3,958,924	1.12½	2,249,389	16,976,708	Dec. '14	0.37½
Nevada Douglas, c.	Nev.	1,000,000	5	0.12½	125,000	....	.....	125,000	Feb. '13	0.12½
Nevada Hills, g.	Nev.	746,000	5	....	.....	....	.....	373,000	Dec. '..	.....
Nevada Wonder, g.s.	Nev.	1,400,000	1	0.20	281,548	0.15	211,181	492,729	Nov. '14	0.05
New Century, z.l.	Mo.	330,000	1	....	.....	....	.....	237,600	Oct. '09	0.01
New Idria, q.	Calif.	100,000	5	0.40	40,000	0.10	10,000	1,680,000	Apr. '14	0.10
North Butte, c.	Mont.	410,000	15	2.00	820,000	1.50	615,000	11,890,000	July '14	0.50
North Star, g.	Calif.	250,000	10	1.20	300,000	1.80	450,000	4,537,040	Dec. '14	0.70
Old Dominion M. & Sm., c.	Ariz.	162,000	25	5.00	10,000	2.75	445,000	3,807,000	Dec. '14	0.50
Ophir, s.g.	Nev.	201,600	3	....	.....	....	.....	2,068,360	Jan. '12	0.10
Opohongo, g.s.l.	Utah	898,978	0.25	0.02	17,980	....	.....	80,907	Jan. '13	0.02
Optimo, z.	Wis.	490	100	....	.....	....	.....	26,460	Nov. '12	5.00
Oroville Dredging	Calif.	700,000	5	....	.....	0.24	170,100	1,553,137	Aug. '14	0.12
Osceola, c.	Mich.	96,150	25	10.50	1,009,575	3.00	288,450	12,179,675	July '14	1.00
Osceola, l.z.	Mo.	98,000	5	....	.....	....	.....	252,350	Oct. '12	0.07½
Parrot, c.	Mont.	229,850	10	0.60	137,908	0.60	137,908	7,428,245	Nov. '14	0.15
Pearl Con., g.	Wash.	1,909,711	0	....	.....	....	.....	181,422	Dec. '10	0.02
Pharmacist, g.	Colo.	1,500,000	1	....	.....	....	.....	87,500	Feb. '10	0.01½
Pioneer, g.	Ida.	1,000,000	1	....	.....	....	.....	2,041,526	Oct. '11	0.03
Pittsburgh-Idaho, l.	Ida.	1,000,000	1	....	.....	....	.....	216,810	Oct. '12	0.04
Pittsburgh-Silver Peak, g.	Nev.	2,790,000	1	0.06	167,400	0.04	111,600	771,200	July '14	0.02
Portland, g.	Colo.	3,000,000	1	0.10	300,000	0.10	300,000	9,757,080	Oct. '14	0.02
Quartette, g.s.	Nev.	101,000	10	....	.....	....	.....	420,000	Sept. '07	0.10
Quilip, g.	Wash.	1,500,000	1	....	.....	....	.....	67,500	Feb. '12	0.01
Quincy, c.	Mich.	110,000	25	3.75	412,500	0.50	55,000	20,897,500	Dec. '14	0.50
Ray Con., c.	Ariz.	1,482,436	...	1.12½	1,631,504	1.12½	1,634,692	3,266,796	Sept. '14	0.37½
Republic, g.	Wash.	8,500,000	1	....	.....	....	.....	170,000	Nov. '12	0.01
Rochester, l.z.	Mo.	4,900	100	....	.....	....	.....	190,846	July '12	0.50
Round Mt., g.	Nev.	866,426	1	0.04	34,961	....	.....	363,365	Aug. '13	0.04
St. Joseph, l.	Mo.	1,464,798	10	0.50	500,000	0.25	361,883	9,422,240	Dec. '14	0.05
Seven Tr. Coalition, g.	Nev.	1,500,000	1	....	.....	....	.....	37,500	July '12	0.02½
Shannon, c.	Ariz.	300,000	10	0.50	150,000	....	.....	650,000	Jan. '13	0.50
Shattuck-Arizona, c.	Ariz.	350,000	10	1.50	525,000	1.50	525,000	2,100,000	July '14	0.50
Silver King Coalition, l.s.	Utah	1,250,000	5	0.30	375,000	0.15	187,500	2,534,850	Apr. '14	0.15
Silver King Con., l.s.	Utah	637,582	1	0.50	308,791	0.40	251,032	559,824	Dec. '14	0.10
Sioux Con., l.s.g.	Utah	746,389	1	....	.....	....	.....	872,097	July '11	0.04
Skidoo, g.	Calif.	1,000,000	5	....	.....	0.04	40,000	365,000	Oct. '14	0.01
Snowstorm, c.g.	Ida.	1,500,000	1	0.04½	112,463	....	.....	1,192,103	Oct. '13	0.00½
Standard Con., g.s.	Calif.	178,394	10	0.25	44,598	....	.....	5,274,207	Nov. '13	0.25
Stratton's Ind., g.	Colo.	1,000,000	10	0.06	60,750	0.03	30,375	456,625	Dec. '14	0.03
Success, z.	Ida.	1,500,000	1	0.06	90,000	....	.....	930,000	June '13	0.01
Superior & Pitts, c.	Ariz.	1,499,792	10	1.52	1,279,688	1.76	2,639,639	8,578,820	Dec. '14	1.00
Stewart, s.l.	Ida.	1,238,262	1	0.32½	402,415	0.60	742,956	1,145,373	Dec. '14	0.13
Tamarack, c.	Mich.	60,000	25	....	.....	....	.....	9,420,000	July '07	4.00
Tennessee, c.	Tenn.	200,000	25	3.75	750,000	2.25	450,000	4,306,250	Oct. '14	0.75
Tomboy, g.s.	Colo.	300,000	4.86	0.96	301,320	0.96	301,320	3,634,065	Dec. '14	0.48
Tonopah-Belmont, s.g.	Nev.	1,500,000	1	1.10	1,650,000	1.10	1,650,000	6,893,003	Oct. '14	0.25
Tonopah Ext., g.s.	Nev.	943,433	1	0.07½	70,764	0.25	224,858	636,817	Oct. '14	0.07½
Tonopah of Nev., s.g.	Nev.	1,000,000	1	1.45	1,450,000	1.00	1,000,000	12,100,000	Oct. '14	0.25
Tri-Mountain, c.	Mich.	100,000	25	2.00	.....	....	.....	1,450,000	Dec. '13	2.00
Tuolumne, c.	Mont.	800,000	1	0.20	160,000	....	.....	520,000	May '13	0.10
Tom Reed, g.	Ariz.	909,555	1	0.66	606,306	0.72	654,756	2,264,764	Dec. '14	0.06
Uncle Sam, g.s.l.	Utah	500,000	1	....	.....	....	.....	495,000	Sept. '11	0.05
United Copper, com.	Mont.	450,000	100	....	.....	....	.....	5,962,500	Aug. '07	1.75
United Copper, pf.	Mont.	50,000	100	....	.....	....	.....	1,500,000	May '07	3.00
United, z.l., com.	Mo.	92,400	5	....	.....	....	.....	27,490	Oct. '08	0.05
United, z.l., pf.	Mo.	19,556	25	....	.....	....	.....	312,782	Jan. '08	0.50
United (Crip. Ck.) g.	Colo.	4,000,100	1	....	.....	....	.....	440,435	Jan. '10	0.04
United, c.	Wash.	1,000,000	1	....	.....	....	.....	40,000	Nov. '12	0.01
United Globe, c.	Ariz.	23,000	100	30.00	690,000	26.00	598,000	2,127,500	Dec. '14	7.00
United Verde, c.	Ariz.	300,000	10	6.75	2,025,000	3.75	1,125,000	34,597,000	Nov. '14	0.75
Utah (Fish Springs), s.l.	Utah	100,000	10	....	.....	....	.....	281,860	Dec. '10	0.02
Utah Copper, c.	Utah	2,797,182	10	3.00	4,746,645	2.25	4,527,924	25,807,813	Dec. '14	0.75
Utah Con., c.	Utah	300,000	5	1.50	450,000	2.00	600,000	8,550,000	Dec. '14	0.50
Valley View, g.	Colo.	1,000,000	1	....	.....	....	.....	240,000	Dec. '11	0.04
Victoria, g.s.l.	Utah	251,000	1	....	.....	....	.....	207,500	Mar. '10	0.04
Vindicator Con., g.	Colo.	1,500,000	1	0.12	180,000	0.12	270,000	3,082,000	Dec. '14	0.06
Wasp No. 2, g.	S. D.	500,000	1	0.11	55,000	0.05	25,000	461,966	Oct. '14	0.01
Wellington, g.	Colo.	10,000,000	1	0.01	100,000	....	.....	350,000	July '13	0.00½
West End Con., g.	Nev.	1,868,486	1	0.05	93,424	0.15	280,277	373,701	Aug. '14	0.01

DIVIDENDS OF MINING COMPANIES IN THE UNITED STATES—Continued

COMPANY NAME	SITUATION	SHARES Issued	SHARES Par Value	DIVIDENDS PAID 1913 Per Share	1913 Total	1914 Per Share	1914 Total	To Date Total	Latest Date	Latest Amount
Wolverine, c	Mich.	60,000	$25	$5.00	$300,000	$4.00	$240,000	$7,980,000	Dec. '14	$2.00
Work, g	Colo.	1,500,000	1	....	.....	....	.....	172,500	July '08	0.00½
Yak, s.l	Colo.	1,000,000	1	0.08	80,000	0.11	110,000	1,847,685	Dec. '14	0.02
Yankee Con., s.l.g	Utah	1,000,000	1	0.01	10,000	....	.....	167,500	Jan. '13	0.01
Yellow Aster, g	Calif.	100,000	10	0.45	45,000	....	.....	1,154,789	July '13	0.05
Yellow Pine, z.l.s	Nev.	1,000,000	1	0.23	219,500	0.11	110,000	453,008	Dec. '14	0.03
Yosemite, g	Calif.	24,000	10	1.20	28,800	1.20	28,800	125,983	Dec. '14	0.02
Yukon Gold, g	Alas.	3,500,000	5	0.30	1,050,000	0.30	1,050,000	6,622,000	Dec. '14	0.07½
Total	.....	.....	....	....	$73,440,701	....	$55,563,960	$804,403,037	.....	.....
IRON, INDUSTRIAL AND HOLDING COMPANIES										
Amalgamated, c	Mont.	1,538,879	$100	$6.00	$9,233,274	$5.00	$8,079,115	$90,125,988	Nov. '14	$0.50
Am. Sm. & Ref., com	U. S.	500,000	100	4.00	2,000,000	4.00	2,000,000	27,333,333	Dec. '14	1.00
Am. Sm. & Ref., pf	U. S.	500,000	100	7.00	3,500,000	7.00	3,500,000	50,458,333	Dec. '14	1.75
Am. Smelters, pf. A	U. S.	170,000	100	6.00	1,020,000	6.00	1,020,000	9,945,000	Oct. '14	1.50
Am. Smelters, pf. B	U. S.	300,000	100	5.00	1,500,000	5.00	1,500,000	14,375,000	Oct. '14	1.25
Bethlehem Steel	Penn.	149,100	100	5.00	745,400	5.00	745,400	3,018,870	Oct. '14	1.25
Cambria Steel	Penn.	900,000	50	2.50	2,250,000	2.50	2,250,000	20,710,000	Nov. '14	0.62½
Crucible Steel, pf	Penn.	244,365	100	7.00	1,710,552	3.50	855,275	16,883,813	June '14	1.75
General Development	U. S.	30,000	100	1.50	44,982	....	.....	2,813,982	June '13	1.50
Great Nor. Ore	Minn.	1,500,000	100	0.50	750,000	0.50	750,000	10,500,000	Dec. '14	0.50
Guggenheim Expl	U. S.	831,732	25	3.75	2,287,263	3.87½	2,222,969	20,200,227	Oct. '14	0.87½
Inter'l Nickel, com	U. S.	379,253	100	10.50	3,982,159	10.00	3,792,532	14,846,433	Dec. '14	2.50
Intern'l Nickel, pf	U. S.	86,661	100	6.00	534,756	6.00	534,756	8,224,802	Nov. '14	1.50
Intern'l Sm. & Ref	U. S.	100,000	100	8.00	800,000	4.00	400,000	3,900,000	May '14	2.00
Lackawanna Steel, pfd	N. Y.	349,780	100	6.25	2,186,125	7.00	2,448,460	4,634,585	Dec. '14	1.75
National Lead, com	N. Y.	206,554	100	3.00	619,660	3.00	619,660	8,415,884	Dec. '14	0.75
National Lead, pf	N. Y.	243,676	100	7.00	1,705,732	7.00	1,705,732	29,266,672	Dec. '14	1.75
Old Dominion, c	Ariz.	293,245	25	5.00	1,566,764	4.00	1,173,412	5,853,713	Dec. '14	0.25
Penn Salt	Penn.	100,000	50	3.00	300,000	6.00	600,000	16,658,000	Oct. '14	1.50
Penn Steel, pf	Penn.	165,000	100	4.00	600,000	....	.....	13,201,000	Nov. '13	2.50
Phelps, Dodge & Co	U. S.	449,346	100	16.50	7,425,000	10.50	6,300,000	36,659,304	Sept. '14	2.50
Republic I. & S., pf	U. S.	204,169	100	8.00	1,633,353	5.25	1,171,788	15,322,845	July '14	1.75
St. Mary's Min. Land	Mich.	160,000	25	3.00	.....	....	.....	5,240,000	Dec. '13	1.00
Sloss-Sheffield, com	Ala.	100,000	100	....	.....	....	.....	2,608,000	Dec. '10	1.25
Sloss-Sheffield, pf	Ala.	67,000	100	7.00	469,000	7.00	469,000	6,665,650	Oct. '14	1.75
U. S. Red. & Ref	Colo.	99,646	100	....	.....	....	.....	1,360,294	Oct. '07	0.01
U. S. Steel Corp., pf	U. S.	3,602,811	100	7.00	25,219,677	7.00	25,219,677	370,293,337	Nov. '14	1.75
U. S. Steel Corp, com	U. S.	5,083,025	100	5.00	24,415,125	4.25	21,602,856	222,360,439	Dec. '14	0.50
U. S. Sm., Ref. & Min., com.	U. S.	351,073	50	3.00	1,053,315	2.25	789,995	6,362,181	July '14	0.75
U. S. Sm., Ref. & Min., pf	U. S.	486,269	50	3.50	1,702,120	3.50	1,702,146	14,667,393	Oct. '14	0.87½
Vulcan Detinning, pfd	U. S.	15,000	100	24.00	367,500	....	.....	1,155,000	Nov. '13	21.00
Warwick I. & S	U. S.	148,671	10	0.80	118,936	2.42	329,782	1,318,398	Nov. '13	0.40
Total	.....	.....	.....	.....	$99,740,693	.....	$91,782,505	1,055,378,476	.....	.....
FOREIGN MINING COMPANIES										
Amparo, g.s	Mex.	2,000,000	$1	$0.10	$320,000	$0.14	$280,000	$1,520,883	Nov. '14	$0.03
Ajuchitlan, g.s	Mex.	50,000	5	....	.....	....	.....	212,500	Oct. '12	0.25
Batopilas, g.s	Mex.	446,496	20	....	.....	....	.....	55,870	Dec. '07	0.01¾
Beaver Con., s	Ont.	1,996,490	1	0.93	59,989	0.03	59,989	469,868	July '14	0.03
Blanca y Anexas, s	Mex.	140,000	10	4.50	315,000	0.90	63,000	1,943,000	Mar. '14	0.90
B. C. Copper, c	B. C.	591,709	5	0.15	88,756	....	.....	615,198	Jan. '13	0.15
Buffalo, s	Ont.	1,000,000	1	0.56	560,000	0.28	280,000	2,757,000	July '14	0.05
Butter's Salvador, g	C. A.	150,000	4.86	0.72	109,350	....	.....	3,802,050	Aug. '13	0.36
Canadian Goldfields, g	Can.	600,000	0.10	0.003	120,000	0.002¼	110,000	290,000	July '14	0.001¼
Cananea Central, c	Mex.	600,000	10	....	.....	....	.....	2,913,020	.... '12	.....
Caribon Cobalt, s	Ont.	1,000,000	1	0.02½	25,000	0.07½	75,000	100,000	Sept. '14	0.02½
Casey Cobalt, s	Ont.	244,950	4.86	0.24	59,523	0.36	89,284	148,807	May '14	0.12
Chontalpan, g.s.l.z	Mex.	7,000	0.25	4.00	29,750	3.00	21,000	57,750	Apr. '14	0.75
City of Cobalt, s	Ont.	1,500,000	1	....	.....	....	.....	139,385	Apr. '09	0.03
Cobalt Central, s	Ont.	5,000,000	1	....	.....	....	.....	188,460	Aug. '09	0.01
Cobalt Lake, s. *d*	Ont.	3,000,000	1	0.10½	315,000	0.05	150,000	465,000	May '14	0.02½
Cobalt Lake (holding)	Can.	300,000	4.86	0.60	182,250	0.24	145,800	328,050	May '14	0.24
Coniagas, s	Ont.	800,000	5	1.60	1,280,000	1.20	960,000	6,640,000	Nov. '14	0.30
Crown Reserve, s	Ont.	1,768,814	1	0.48	849,031	0.24	424,515	5,960,903	Dec. '14	0.02
Cobalt Town Site, s. *c*	Ont.	199,282	4.86	0.72	363,188	0.96	484,250	947,700	May '14	0.48
Cobalt Town Site, s. *d*	Ont.	45,000	1	8.25	371,000	0.45	200,000	1,042,259	Apr. '14	0.10
Con. M. & S. of Can	Can.	58,052	100	4.00	232,176	8.00	464,352	1,710,589	Oct. '14	2.00
Dolores, g.s	Mex.	400,000	5	....	.....	....	.....	1,374,866	Jan. '11	0.22½
Dos Estrellas, g.s	Mex.	300,000	0.50	5.25	2,025,000	....	.....	10,335,000	Dec. '13	1.50
Enciño y Anexas, s	Mex.	3,000	10	4.00	12,000	5.03½	15,105	30,105	Mar. '14	3.03½
El Favor, g	Mex.	3,500,000	1	0.04	140,000	0.02	70,000	210,000	Apr. '14	0.01
El Oro, g.s	Mex.	1,147,500	4.86	0.34	57,375	....	.....	8,947,260	July '13	0.24
El Rayo, g.s	Mex.	260,020	2	....	.....	....	.....	140,410	Apr. '11	0.15
Esperanza, s.g	Mex.	455,000	4.86	0.48	331,695	0.24	165,847	11,996,303	Jan. '14	0.24
Granby, s.l.c	B. C.	148,481	100	6.00	890,884	3.00	445,442	5,533,437	June '14	1.50
Greene Cananea, c	Mex.	450,642	100	1.20	1,093,143	3.00	1,458,626	4,371,647	June '14	1.00
Greene Con., c	Mex.	1,000,000	10	0.95	950,000	1.00	1,000,000	9,544,400	May '14	0.50
Guanajuato D., pf., s	Mex.	10,000	100	....	.....	....	.....	274,356	Jan. '11	3.00
Hedley Gold	B. C.	120,000	10	3.00	360,000	2.50	300,000	1,524,000	Dec. '14	1.00
Hollinger, g	Ont.	600,000	1	1.95	1,170,000	1.80	1,170,000	2,610,000	Dec. '14	0.15
Jimulco, c.s	Mex.	10,000	100	1.00	10,000	....	.....	985,000	Mar. '13	1.00
Kerr Lake, s	Ont.	600,000	5	1.00	600,000	1.00	600,000	5,520,000	Dec. '14	0.25
La Rose Con., s	Ont.	1,498,625	5	1.00	1,498,624	1.20	899,176	4,974,998	Oct. '14	0.25
Le Roi No. 2, g	B. C.	120,000	24.25	0.36	43,740	....	.....	1,472,580	Jan '13	0.36
Lucky Tiger Com., g	Mex.	715,337	10	0.63	390,663	0.89	634,803	2,698,275	Dec. '14	0.09
McK.-Dar. Sav., s	Ont.	2,247,692	1	0.46	1,023,937	0.21	472,014	4,338,040	Oct. '14	0.03
Mexican, l., pf	Mex.	12,500	100	....	.....	....	.....	1,018,750	Oct. '14	0.03
Mexico Mines of El Oro, g.s.	Mex.	180,000	4.86	3.36	787,320	1.92	349,920	4,458,745	June '14	0.96
Min. Corp. of Can., s	Ont.	2,075,000	1	....	.....	0.12½	259,375	259,375	Nov. '14	0.12½
Mines Co. of Am	Mex.	838,628	10	0.25	210,256	....	.....	4,958,600	July '13	0.12½
Montezuma, l., pf	Mex.	5,000	100	....	.....	....	.....	402,000	Nov. '12	3.50
N. Y. & Hond. Ros., g	C.A.	500,000	10	0.90	180,000	1.20	240,000	3,550,000	Oct. '14	0.30
Nipissing, s	Ont.	1,200,000	5	1.50	1,800,000	1.25	1,500,000	12,390,000	Oct. '14	0.25
Nova Scotia, C. & S., com.	N. S.	60,000	100	6.00	360,000	4.50	270,000	4,440,000	July '14	1.50
Nova Scotia, C. & S., pf	N. S.	10,600	100	8.00	84,800	8.00	84,800	1,189,600	Oct. '14	2.00
Peñoles, s.l.g	Mex.	120,000	15	2.50	300,000	....	.....	6,361,687	June '13	1.50
Peregrina M. & M., pf	Mex.	10,000	100	....	.....	....	.....	328,656	Sept. '10	3.50
Peterson Lake, s	Ont.	5,600,000	1	....	.....	0.05½	189,000	189,000	Dec. '14	0.01¾
Pinguico, pf., s	Mex.	20,000	100	3.00	60,000	....	.....	840,000	Oct. '13	3.00
Right of Way Mines, s	Ont.	1,685,500	1	....	.....	0.01	16,855	543,759	Nov. '14	0.01
Rio Plata, s	Mex.	373,437	5	0.05	18,696	....	.....	345,745	Feb. '13	0.05
Porcupine Crown, g	Ont.	2,000,000	1	....	.....	0.09	180,000	180,000	Oct. '14	0.03
San Rafael, g.s	Mex.	2,400	25	0.50	1,200	....	.....	345,745	Feb. '13	0.05
Santa Gertrudis, g.s	Mex.	$1,368,000	$4.86	$0.24	$364,500	....	.....	$2,090,792	July '13	$0.24
Sen Toy	Mex.	6,000,000	1	0.02	120,000	....	.....	530,000	July '13	0.01
Seneca-Superior, s	Ont.	476,830	1	0.52	310,774	$0.70	$335,218	645,993	Dec. '14	0.10
Sorpresa, g.s	Mex.	19,200	20	....	.....	....	.....	3,979,240	Jan. '11	34.00
Standard, s.l	B. C.	2,000,000	1	0.32½	650,000	0.23½	475,000	1,550,000	Sept. '14	0.02½

FOREIGN MINING COMPANIES—Continued

COMPANY NAME	SITUATION	SHARES Issued	SHARES Par Value	DIVIDENDS PAID 1913 Per Share	1913 Total	1914 Per Share	1914 Total	To Date Total	Latest Date	Latest Amount
Temiskaming, s.	Ont.	2,500,000	$1	$0.03	$75,000	....	.....	$1,384,156	Apr. '13	$0.03
Tem. & Hud. Bay, s.	Ont.	7,761	1	21.00	162,981	9.00	69,849	1,940,250	Nov. '14	3.00
Tretheway, s.	Ont.	1,000,000	1	0.15	150,000	0.05	50,000	1,061,998	July '14	0.05
Wettlaufer-Lorrain, s.	Ont.	1,416,590	1	0.10	141,659	....	.....	637,465	Oct. '13	0.05
Total	.....	.....	.....	.....	$21,654,260	.....	$15,058,220	$164,810,525	.....	.....

a Two classes. *b* New series only. *c* Holding company. *d* Operating company.

Data of the World's Principal Mines

By S. F. Shaw‡

Compiled from Annual Reports of the Respective Companies

Name of Mine	Situation	Year	Tons	Profit	Dividends	Reserves Tons	Development Feet	Price Rec'd per Ton	Cost per Ton
Abosso Gold	W. Af.	'12-'13	104,400	.....	.....	266,401	.....	$8.57	.....
Ahmeek	U. S.	1913	283,749	176,919	1,100,000	.....	.....	.....	.....
Allouez	U. S.	1913	263,663	155,728	None	.....	.....	.....	$2.09
Amalgamated Zinc	Aus.	½-1913	245,064	£82,486	£100,000	.....	.....	.....	.....
Anaconda	U. S.	1913	4,651,445	11,323,498	12,997,500	.....	.....	.....	7.10
Anchor Tin	Tas.	'12-'13	86,240	£56	.....	.....	.....	.....	0.99
Arizona Copper	U. S.	'12-'13	936,003	£406,035	£233,516	.....	.....	5.62	3.89
Ashanti Goldfields	W. Af.	'12-'13	153,554	£175,417	£187,507	365,600	18,278	15.60	9.40
Associated Gold Mining	Aus.	'12-'13	125,169	£17,258	£12,384	500,000	3,336	6.43	5.58
Associated Northern Blocks	Aus.	'12-'13	97,639	£38,452	£35,000	.....	.....	.....	.....
Balaghat Gold	India	1913	42,700	£2,348	.....	21,886	5,498	.....	.....
Baltic	U. S.	1913	333,289	230,211	200,000	.....	.....	3.46	2.76
Blackwater	N. Z.	1913	45,052	£20,631	£12,499	104,727	3,730	8.89	6.67
British Broken Hill	Aus.	½-1913	95,662	£50,968	£52,909	.....	.....	.....	.....
British Columbia Copper	B. C.	1913	353,422	58,325	88,756	.....	.....	.....	.....
Broken Hill North	Aus.	½-1913	153,680	£155,070	£120,000	.....	.....	.....	.....
Broken Hill Block 10	Aus.	½-1913	46,119	£16,860	£20,000	110,800	.....	7.58	.....
		½-1913	47,174	£37,481	£20,000	.....	.....	.....	.....
Broken Hill Block 14	Aus.	½-1913	16,495	£7,305	£16,500	.....	.....	.....	.....
		½-1913	23,856	£9,471	£10,000	.....	.....	13.09	10.36
Broken Hill Proprietary	Aus.	'12-'13	120,567	£124,191	£170,000	.....	.....	.....	.....
Broken Hill South	Aus.	½-1913	151,836	.....	768,000	.....	5,522	9.49	5.44
Buffalo	Ont.	'12-'13	55,783	891,192	650,000	57,330	.....	22.77	6.59
Bunker Hill & Sullivan	U. S.	1913	436,663	1,119,961	817,500	3,842,010	2,203	8.91	2.73*
Butte & Superior	U. S.	1913	296,940	937,794	None	.....	.....	11.88	8.71
Calumet & Arizona	U. S.	1913	134,356	.....	3,059,208	.....	.....	33.89	.....
Camp Bird	U. S.	1913	30,012	.....	£45,500	31,000	.....	22.49	14.61
Cape Copper	Cape Co. 1	'12-'13	72,756	£83,500	£69,000	161,970	.....	.....	.....
Carn Brea & Tincroft	Eng.	½-1913	45,537	—£2,785	.....	.....	.....	5.51	5.81
Centennial	U. S.	1913	85,443	31,549	None	.....	.....	.....	2.52
Champion	U. S.	1913	421,849	504,767	900,000	.....	.....	4.27	3.06
Champion Reef	India	'12-'13	220,511	£153,086	£130,000	404,125	.....	11.26	7.88
Chino Copper	U. S.	1913	1,942,700	3,021,887	1,919,070	90,000,000	.....	3.92	2.46
Coniagas	Ont.	'12-'13	55,618	.....	1,640,000	199,025	2,966	.....	.....
Con Goldfields of N. Z.	N. Z.	1913	23,661	£6,292	.....	.....	.....	.....	.....
Con. Main Reef	Tran.	'12-'13	266,715	£33,748	£92,436	614,470	.....	7.43	4.88*
Con. Mining & Smelting	B. C.	'12-'13	407,124	.....	232,176	.....	38,741	.....	.....
Copper Queen	U. S.	1913	867,481	6,916,900	5,700,000	2,567,928	101,142	.....	.....
Creston	Mex.	1913	130,654	.....	.....	306,300	9,570	6.20	.....
Crown Mines	Tran.	1913	2,483,622	£1,442,473	£1,034,116	10,449,000	.....	6.31	3.94*
Crown Reserve	Ont.	1913	29,543	528,288	795,966	72,472	5,345	35.67	13.80
Daly Judge	U. S.	1913	48,943	.....	180,000	.....	16,481	.....	.....
Detroit	U. S.	1913	533,563	1,112,870	780,000	.....	24,689	.....	.....
Dolcoath	Eng.	½-1913	58,304	£27,142	£17,500	.....	.....	8.83	6.86
		½-1913	56,409	£5,165	£8,750	.....	.....	6.86	6.53
Dolores	Mex.	1913	41,952	.....	None	100,932	7,245	.....	.....
Dome	Ont.	1913	145,305	287,779	None	512,000	6,802	8.29	6.66
East Butte	U. S.	1913	186,815	.....	None	.....	.....	13.23	10.07
El Dorado Banket	Rhod.	'12-'13	87,176	£101,414	£90,000	74,826	.....	12.39	6.89
El Oro Mg. & Ry	Mex.	'12-'13	253,434	tailing					
			180,274	ore	57,375	448,053	.....	5.05	.....
El Rayo	Mex.	1913	.....	.....	None	54,800	5,572	.....	.....
Esperanza	Mex.	1913	207,443	tailing					
			85,843	ore 491,232	247,500	113,500	.....	.....	.....
Ferreira Deep	Tran.	'12-'13	647,550	£631,432	£490,000	1,974,400	.....	9.84	4.88*
Franklin	U. S.	1913	123,179	.....	None	160,162	2,399	.....	.....
Franklin Furnace	U. S.	1913	490,434	.....	.....	.....	.....	19.00	.....
Frontino & Bolivia	Bol.	'12-'13	32,888	£13,443	.....	15,900	.....	12.86	11.29
Gaika Gold	Rhod.	'12-'13	33,549	£989	.....	71,893	.....	8.62	8.05
Giant	Rhod.	'12-'13	131,887	£75,645	£77,125	.....	.....	6.63	3.84
Globe & Phoenix	Rhod.	'12-'13	36,628	£163,369	.....	175,805	.....	.....	10.46
Glynn's Lydenberg	Tran.	'12-'13	40,642	£38,216	£34,000	.....	.....	10.22	7.07
Golden Horseshoe	Aus.	1913	280,512	£42,698	£60,000	715,496	9,485	.....	5.40
Goldfield Con	U. S.	1913	349,465	2,731,945	2,491,404	136,000	38,696	14.14	6.38
Great Boulder Perseverance	Aus.	1913	244,841	£6,897	.....	516,978	8,065	.....	4.31
Great Boulder Proprietary	Aus.	1913	189,469	£301,657	£262,500	614,114	2,525	14.50	5.86
Great Cobar	N. S. W.	'12-'13	288,172	£81,925	.....	2,390,280	.....	.....	.....
Great Fingael	Aus.	1913	64,255	—£12,550	£12,500	.....	1,921	.....	.....
Great Fitzroy	Aus.	'12-'13	107,098	£549	.....	.....	.....	9.11	9.09
Greene-Cananea	Mex.	1913	673,034	.....	1,093,143	.....	49,505	.....	.....
Grenville	Eng.	½-1913	22,227	£14,445	£13,117	.....	.....	10.50	7.37
		½-1913	21,770	£5,668	£4,386	.....	.....	8.06	6.80
Hecla	U. S.	1913	141,930	292,696	320,000	.....	.....	.....	.....
Hedley Gold	B. C.	1913	70,796	405,255	360,000	.....	.....	11.31	5.61
Hollinger	Ont.	1913	138,291	1,508,661	1,170,000	845,300	.....	17.84	6.98
Homestake	U. S.	1913	1,540,961	.....	2,146,225	.....	16,999	4.01	2.72
Hutti Gold Mines	India	1913	27,733	.....	.....	30,000	.....	8.26	.....
Independence	U. S.	'12-'13	104,111	dump					
			25,999	mine	121,500	.....	.....	.....	.....
Inspiration	U. S.	1913	.....	.....	None	89,643,000	.....	.....	.....
Iron Blossom	U. S.	1913	39,527	510,617	400,000	.....	6,081	28.15	15.23
Iron Silver	U. S.	1913	47,668	.....	.....	.....	.....	7.47	.....

Note—Abbreviations used in above table: Alas., Alaska; Braz., Brazil; Can., Canada; Eng., British Isles (Cornwall); Hon., Honduras; Ind., India; Malay, Malay States; Mex., Mexico; N. S. W., New South Wales; N.Z., New Zealand; Port., Portugal; Rhod., Rhodesia; Sib., Siberia; S. A., South Africa; Tas., Tasmania; Tran., Transvaal; U. S., United States; W. Af., West Africa.

—Loss for the year. *Cubic yards. All profits and dividends are in dollars except where otherwise noted.

The omission of a figure simply indicates that the company report gave no information on this subject.

‡Superintendent, Charcas Unit, National Metallurgical Co., Charcas, S. L. P., Mex.

DATA OF THE WORLD'S PRINCIPAL MINES—(Continued)

Name of Mine	Situation	Year	Tons	Profit	Dividends	Reserves Tons	Development Feet	Price Rec'd per Ton	Cost per Ton
Isle Royale	U. S.	1913	314,679	232,302	150,000	.....	.....	.....	2.45
Ivanhoe	Aus.	1913	239,314	.....	.....	991,417	3,728	.....	.....
Jumbo Gold	Rhod.	'12-'13	37,180	—£17,350	.....	.....	.....	.....	.....
Kalgurli	Aus.	'12-'13	128,415	£101,961	£96,000	250,000	3,759	9.69	5.81
Kerr Lake	Ont.	'12-'13	18,792	837,315	600,000	.....	4,984	61.92	18.36
Knights Deep	Tran.	'12-'13	1,009,730	£172,401	£144,793	2,777,000	.....	.....	.....
Kyshtim Corp	Sib.	1913	351,043	£311,578	£314,058	356,000	.....	.....	.....
Lake Copper	U. S.	'12-'13	83,109	—52,441	None	.....	.....	2.64	3.27
Le Roi No. 2	B. C.	'12-'13	35,555	.....	43,740	.....	4,633	7.33	7.12
Lena Goldfields	Sib.	'12-'13	820,189	.....	.....	.....	.....	.....	.....
Lucky Tiger	Mex.	1913	.....	.....	450,662	.....	2,585	.....	4.38
Main Reef West	Tran.	'12-'13	232,058	£38,144	£24,559	591,830	.....	7.31	6.51
McKinley-Darragh-Savage	Ont.	1913	.....	771,487	1,023,937	.....	.....	.....	.....
Mexican	U. S.	1913	15,973	.....	.....	.....	.....	.....	10.40
Mexico Mines of El Oro	Mex.	'12-'13	.....	£191,886	£162,000	.....	.....	.....	.....
Miami	U. S.	1913	1,058,754	1,534,685	1,491,979	20,300,000	37,697	4.77	3.39
Minerals Separation	Aus.	1913	.....	£5,090	.....	.....	.....	.....	.....
Moctezuma	Mex.	1913	603,654	2,402,447	1,950,000	.....	22,710	.....	.....
Mohawk	U. S.	1913	366,458	.....	500,000	.....	.....	.....	.....
Montana-Tonopah	U. S.	'12-'13	52,402	.....	100,000	32,000	6,773	11.58	.....
Mt. Bischoff	Tas.	¾-1913	116,063	163,000	173,000	.....	.....	3.23	1.18
Mt. Elliott	Aus.	'12-'13	41,633	£141,811	£202,837	430,000	.....	48.46	.....
Mt. Lyell	Tas.	¾-1913	84,833	134,000	.....	3,373,616	1,214	.....	.....
Mt. Morgan	Aus.	'12-'13	322,098	£331,708	£200,000	3,347,000	.....	17.20	12.20
Mysore	India	1913	302,662	2,352,000	1,824,000	1,377,102	27,331	.....	.....
Nevada Con	U. S.	1913	3,169,108	2,345,564	3,998,914	39,108,590	.....	3.22	2.95
Nevada Hills	U. S.	1913	41,919	176,966	None	.....	6,243	12.18	7.95
Nevada Wonder	U. S.	'12-'13	39,118	.....	281,399	.....	6,832	13.70	12.80
New Idria	U. S.	1913	76,993	65,013	40,000	.....	.....	4.71	3 87
New York & Honduras Rosario	Hond.	1913	91,606	575,343	220,000	355,396	15,689	15.06	9.81
New Modderfontein	Tran.	'12-'13	565,400	£483,926	£420,000	4,547,000	.....	9.62	5.46
New Reitfontein	Tran.	1913	185,830	£14,225	£15,252	57,737	.....	5.20	4.84
Nipissing	Ont.	1913	77,240	1,824,365	1,800,000	216,644	13,644	.....	14.81
North Butte	U. S.	1913	462,799	.....	820,000	.....	19,499	11.20	.....
North Star	U. S.	1913	106,090	.....	300,051	.....	3,158	11.32	5.20
Nourse	Tran.	'12-'13	577,200	£254,731	.....	1,795,600	27,805	7.33	5.18*
Nundydroog	India	1913	90,650	.....	475,200	.....	.....	17.64	7.28
Old Dominion	U. S.	1913	169,961	481,445	690,000	.....	.....	.....	.....
Ooregum	India	1913	153,536	£174,832	£129,251	189,947	14,813	.....	5.44
Oriental Con	Chosen	'12-'13	313,701	571,384	429,390	805,900	33,248	5.60	3.47
Oroya-Black Range	Aus.	'12-'13	59,680	.....	.....	.....	.....	8.73	6.46*
Oroya Links	Aus.	1913	139,130	£15,899	.....	146,775	5,960	5.38	3.86*
Osceola	U. S.	1913	735,044	381,967	721,125	.....	.....	2.39	1.75
Otavi	W. A.	'12-'13	54,100	.....	.....	.....	.....	.....	.....
Ouro Preto	Brazil	1913	66,139	—£3,503	.....	114,528	.....	6.56	6.59
Pahang Con	Malay	'12-'13	127,543	£49,796	£36,874	.....	.....	7.53	5.55
Portland	U. S.	1913	127,054 dump 53,245 ore	.....	300,000	.....	12,433	.....	.....
Prestea Block A	W. A.	1913	229,990	£38,340	.....	691,670	5,660	6.16	7.37
Princess Estate	Tran.	1913	257,476	£4,505	.....	614,000	.....	7.39	6.05
Progress	N. Z.	1913	34,996	—£2,431	.....	.....	.....	7.40	7.74
Ray Con	U. S.	1913	2,366,007	2,398,466	1,631,504	78,380,966	.....	3.34	2.38
Rio Tinto	Sapin	1913	1,859,571	£1,673,372	£1,487,500	.....	.....	.....	.....
Robinson	Tran.	1913	668,900	3,500,000	2,010,000	10,073,000	.....	8.58	3.83*
Robinson Deep	Tran.	'12-'13	623,800	£269,579	£275,000	1,538,000	.....	7.15	5.06
Rooiberg Minerals	Tran.	'12-'13	14,175 dump 21,742 ore	.....	£65,000	.....	.....	.....	.....
Round Mountain	U. S.	'12-'13	57,360	29,150	.....	155,500	4,716	4.92	4.55
Santa Gertrudis	Mex.	12'-'13	263,625	.....	1,093,500	.....	.....	11.70	.....
San Toy	Mex.	1913	7,056	.....	115,000	.....	4,007	.....	.....
Selukwe-Columbia	Rhod.	'12-'13	37,263	£14,662	.....	.....	.....	.....	.....
Seoul Mining	Chosen	1913	71,535	.....	500,000	592,418	5,505	9.39	4.13*
Shannon Copper	U. S.	1913	364,584	476,440	150,000	.....	13,600	.....	.....
Sheba Gold	Tran.	'12-'13	68,920	£42,281	£47,204	110,000	.....	11.31	8.31
Silver King Coalition	U. S.	'12-'13	100,225	.....	500,000	.....	.....	14.85	10.50
Simmer & Jack	Tran.	'12-'13	912,200	£428,765	£450,000	2,524,000	.....	5.16	2.89
Snowstorm	U. S.	1913	105,674	137,455	112,463	.....	.....	.....	.....
Sons of Gwalia	Aus.	1913	162,101	£66,277	£66,300	625,000	.....	.....	.....
South Crofty	Eng.	1913	69,366	£20,477	£17,500	.....	4,588	7.00	5.81
South Kalgurli	Aus.	'12-'13	112,262	£16,426	£15,000	174,097	4,211	6.09	5.04
Spassky Copper	Sib.	1913	33,663	£226,318	£152,800	342,882	.....	.....	.....
Stewart	U. S.	1913	174,126	.....	561,434	.....	.....	.....	.....
St. John del Rey	Brazil	'12-'13	172,208	£110,652	£64,626	.....	.....	11.18	8.06
Sudan Goldfields	S. A.	1913	17,049	29,000	.....	42,862	5,304	.....	.....
Sulphide Corporation	Aus.	'12-'13	210,440	£280,947	£192,500	2,352,000	.....	.....	.....
Superior & Pittsburgh	U. S.	1913	342,301	.....	2,279,688	.....	.....	19.83	.....
Talisman Con	N. Z.	'12-'13	42,980	.....	129,375	.....	.....	27.38	.....
Tamarack	U. S.	1913	227,563	—49,923	None	.....	.....	.....	.....
Taqua Mining & Exp	W. A.	'12-'13	61,607	£39,698	.....	198,502	.....	.....	.....
Tasmania Gold	Tas.	'12-'13	53,812	—£3,028	.....	.....	3,231	8.17	8.38
Tennessee Copper	U. S.	1913	470,135	.....	750,000	5,534,984	.....	.....	2.93
Tomboy	U. S.	'12-'13	129,618	480,154	£54,250	425,000	.....	8.03	4.39
Tom Reed	U. S.	1913	48,110	.....	606,306	.....	.....	22.30	8.68
Tonopah-Belmont	U. S.	'12-'13	145,245	.....	1,650,000	229,185	12,514	.....	.....
Tonopah Extension	U. S.	'12-'13	54,618	.....	70,764	.....	11,172	.....	8.62
Tonopah Mining	U. S.	'12-'13	173,336	.....	1,450,000	.....	.....	.....	7.19
Treasury Gold	Tran.	'12-'13	78,050	£4,880	£67,500	.....	.....	.....	.....
Trethewey	Ont.	1913	.....	130,697	150,000	.....	.....	.....	.....
Trimountain	U. S.	1913	229,149	113,363	200,000	.....	.....	3.31	2.75
Troitzk Goldfield	Sib.	1913	39,500	—£5,523	.....	22,430	2,799	.....	.....
U. S. S. R. & M. Co	U. S. and Mex.	1913	3,585,586	.....	2,755,435	.....	.....	.....	.....
Utah Apex	U. S.	'12-'13	.....	130,190	None	.....	.....	.....	.....
Utah Consol	U. S.	1913	.....	.....	450,000	.....	20,510	.....	.....
Utah Copper	U. S.	1913	7,519,392	5,795,513	4,747,710	268,000,000	24,812	2.37	1.60
Van Roi	B. C.	'12-'13	25,702	—£20,559	.....	.....	.....	3.00	6.90
Van Ryn	Tran.	'12-'13	456,255	£248,255	£237,500	2,004,529	.....	6.78	4.15
Victoria	U. S.	1913	137,163	.....	None	.....	52,435	.....	.....
Vindicator	U. S.	1913	33,517	.....	180,000	.....	10,187	27.46	.....
Vogelstruis Estate	Tran.	'12-'13	147,603	—£8,833	.....	207,000	.....	5.72	6.01
Waihi	N. Z.	1913	184,768	£108,375	£99,181	764,732	13,466	8.85	6.88
Waihi Grand Jc	N. Z.	1913	98,383	£41,591	£19,219	175,100	5,909	8.78	.....
Wallaroo & Moonta	Aus.	¾-1913	67,860	.....	.....	.....	.....	.....	.....
Wanderer	Tran.	'12-'13	222,445	£11,376	.....	67,931	10,171	1.84	1.59
Wasp N. 2	U. S.	1913	127,680	54,000	55,000	.....	.....	1.72	1.31
West End Con	U. S.	'12-'13	44,756	332,848	93,424	.....	5,859	.....	7.79
Wheal Kitty	Eng.	¾-1913	7,630	£914	£349	.....	910	.....	6.72
Winona	U. S.	1913	120,806	—116,032	None	.....	.....	1.85	2.86
Witwatersrand Deep	Tran.	1913	451,000	£178,522	£137,500	1,492,257	.....	6.78	4.85
Wolhuter	Tran.	'12-'13	340,950	£116,854	£86,000	.....	.....	6.42	4.76*
Wolverine	U. S.	'12-'13	388,502	.....	300,000	.....	.....	.....	1.86
Yukon Gold	Alas.	1913	11,056,554†	1,083,913	1,050,000	.....	.....	0.43	3.35
Zinc Corporation	Aus.	1913	162,966	.....	.....	971,784	.....	.....	.....

* Working cost. † Cu.yd. — Loss for year.

Chronology of Mining for 1914

JANUARY

Jan. 1.—Arizona Copper Co.'s old smelting plant, at Clifton, Ariz., permanently closed.

Jan. 4—Tacoma smelting plant closed on account of strike

Jan. 5—Buckhorn Mining Co.'s 400-ton mill, at Buckhorn, Nev., put in commission.

Jan. 7—Work resumed at Tacoma smelting works.

Jan. 8—Strike of South African state railways' employees.

Jan. 10—Twelve men killed in colliery explosion at Rock Castle, Ala.

Jan. 12—Operations begun in 600-ton testing mill of Inspiration Consolidated Copper Co., Miami, Ariz.—Fire in Negaunee mine, at Negaunee, Mich.; two men killed.

Jan. 15—Miners' union officials in Lake Superior copper country indicted by Houghton County grand jury.

Jan. 16—Strike at Rio Tinto.

Jan. 20—Three men killed at hoist at Coggins mine, Eldorado, N. C.

Jan. 21—Fire in Boston mine of Utah Copper Co., at Bingham, Utah; five deaths, three rescuers losing their lives in attempt to find two miners who were caught in workings.

Jan. 22—Balaklala sampling mill destroyed by fire.

Jan. 24—U. S. Senate passed Alaska railway bill, directing the President to purchase or construct 1000 miles of railroad in Alaska, at a cost not to exceed $40,000,000.

Jan. 27—Leaders in South African railway strike deported, it having been found that they planned starting a revolution.—Cave-in at Capote mine of Cananea Consolidated Copper Co., at Cananea, Sonora; four killed.

Jan. 29—Strike of miners at Coniagas mine, Cobalt, Ontario.

FEBRUARY

Feb. 1—Chino Copper Co. discharged all minors in its employ.

Feb. 2—Three miners killed in cave-in at North Uno mine of Oliver Iron Mining Co., near Hibbing, Minn.

Feb. 9—Congressional investigation of strike in Lake Superior copper country begun.

Feb. 10—Congressional investigation of Colorado coalfields strike begun.

Feb. 12—Chinese government granted important oil concession to Standard Oil Co.

Feb. 15—Three mine guards and a deputy sheriff found guilty of manslaughter for killing a man at the height of the Lake Superior copper strike.

MARCH

Mar. 8—Congressional committee investigating Colorado coal-mine strike completed taking of testimony at Denver.

Mar. 9—Congressional committee, investigating copper-country strike, completed taking of testimony in Michigan.

Mar. 13—Archie L. Wisner and John J. Meyers sentenced to six years each and Meyers in addition fined $10,000 for fraudulent mine promotion.

Mar. 13—Anaconda Copper Mining Co.'s 20-deck round-table plant at Washoe works at Anaconda, put in full operation.

Mar. 16—Tsunmidato copper mine, in Japan, reported to have caved in; 300 men said to have been in the mine at that time.—Hidden Creek smelting works of the Granby Consolidated company, at Anyox, B. C., blown in.

Mar. 18—Alaska railway bill signed by President Wilson.

Mar. 20—Colorado Fuel & Iron Co. brought suit for $1,000,000 damages against United Mine Workers of America and various officials of the organization.

Mar 21—First party of oil-well drillers left San Francisco for the fields in China, recently acquired by the Standard Oil Company.

Mar. 27—Anaconda Copper Mining Co. commenced construction of 2000-ton leaching plant at Washoe works at Anaconda, Mont.

Mar. 28—Reported that liquidation of silver stocks of the failed India Specie Bank had been completed.

Mar. 31—General closing down of coal mines in Ohio because of failure of operators to come to agreement with miners in regard to wage scale.—Erection of steel work begun by American Bridge Co. on main concentrator building of the Inspiration Consolidated Copper Co., at Miami, Arizona.

APRIL

Apr. 1—Underground mining abandoned at Utah Copper Co.'s property, at Bingham Cañon, Utah.

Apr. 2—Sheep Creek tunnel, of Alaska-Gastineau Mining Co., near Juneau, Alaska, holed through.

Apr. 3—Strike at Dean mine, of Hudson Iron Ore Co., near Highland Falls, N. Y.

Apr. 8—Last spike driven on Grank Trunk Pacific Ry., 1½ miles east of Nechacco River Crossing, B. C.

Apr. 12—Michigan copper miners vote to end strike begun July 23, 1912.

Apr. 14 —Strike at Cananea, Mexico.

Apr. 19—U. S. forces land at Vera Cruz.

Apr. 20—Anaconda Copper Mining Co. proposes taking over International Smelting & Refining Co.

Apr. 20-21—Pitched battle between Colorado coal miners and state militia, in coal fields of southern Colorado.

Apr. 24—American Smelting & Refining Co. ordered all American employees out of Mexico.

Apr. 28—President Wilson ordered regular troops to the strike zone in Colorado.—Explosion in collieries of New River Collieries Co., a Guggenheim corporation, at Eccles, W. Va.; 180 lives lost.

MAY

May 1—First shipment of copper from Hidden Creek smelting works, of Granby Consolidated company.—International Zinc Convention begins curtailment of production at rate of about 18 per cent.

May 2—All ore docks in Lake Superior iron country open.

May 4—U. S. Circuit Court of Appeals in San Francisco rendered decision holding Minerals Separation Co.'s froth-flotation patent invalid.

May 14—Oil struck at Calgary, Alta.

May 21—Court of mediation in Mexican political situation convened at Niagara Falls, Canada.

May 23—Fire in Pocahontas mine, Joplin, Mo.

May 26—Stockholders of Anaconda Copper Mining Co. having voted on May 20 to purchase and take over the International Smelting & Refining Co., certificate of surrender of charter of International company was filed in New Jersey.

May 28-31—Celebration of the 50th anniversary of the founding of the School of Mines of Columbia University.

JUNE

June 1—Timber Butte mill, at Butte, Mont., began regular operations treating Elm Orlu ore.

June 10—East Tennessee mine surface plant of Ducktown Sulphur, Copper & Iron Co., at Isabella, Tenn., destroyed by fire.

June 12—Butte miners started rioting in protest against unions levying assessments to support strikers in other districts, charging union officials with irregularity in disposing of union funds.

June 17—Two mills of Witherbee-Sherman & Co., at Mineville, N. Y., destroyed by fire.—Workmen at the Abangarez mine in Costa Rica seized and operated mine and mills when company attempted to shut them down pending introduction of a system for preventing theft of gold.

June 19—Fire in the Vieille Marihaye colliery, near Liége, Belgium, resulted in entombing 200 coal miners.—An explosion in the Hillcrest colliery, Hillcrest, Alta., resulted in the death of 199 miners.

June 21—New union formed by Butte miners to be known as Butte Mine Workers' Union.

June 22—The Supreme Court decided the Intermountain rate case in favor of the Interstate Commerce Commission, and against the railroads.—Supreme Court handed down decision in favor of Southern Pacific R.R. in its California oil lands case.

June 23—Butte miners dynamited old Western Federation Hall.

June 29—Kennedy Extension vs. Argonaut case decided in favor of defendant.

June 30—Mexican Mining Co. settled suits and decided to rejoin Comstock Pumping Association.—Pulverized-coal firing of reverberatories started at Anaconda.

JULY

July 1—Anaconda Copper Mining Co. closed down the concentrator at Great Falls, Mont.

July 2—Cananea striking miners returned to work.

July 3—Suit brought against the American Smelting & Refining Co. by Sidney Norman and others, representing minority stockholders of the Federal Mining & Smelting Co., was dismissed by Justice Philbin.—Railroad strike in the Cripple Creek district, Colorado.

July 6—Circuit Court of Appeals at San Francisco reaffirmed its decision in case of Minerals Separation, Ltd., vs. James M. Hyde.

July 15—Seven miners were killed by a rush of sand into a raise at the Vulcan mine at Alpha, Mich.

July 18—Announcement made that Phelps, Dodge & Co. had taken over the Tombstone Consolidated mines in Arizona.

July 29—Twelve miners were killed by an explosion of dynamite in sinking a shaft in the Krajaii potash mine, near Cassel, Germany.

July 31—Anaconda Copper Mining Co. closed down the Great Falls smelting plant and also seven mines in the Butte district, because of impending war in Europe.—Closing of New York and Boston Stock Exchanges.

AUGUST

Aug. 1—Decision by Interstate Commerce Commission on railroad rate case only partly favorable to roads.—Germany declared war on Russia, this being the beginning of the great war.

Aug. 3—Copper Producers' Association announced suspension of monthly statistics.—Jackling, Hayden-Stone companies announced 50% curtailment of production. (Most of the other copper producers took similar action immediately afterward.)—"Engineering and Mining Journal" suspended quotations of copper and silver.

Aug. 4—Five men killed and four injured by premature blast in steam-shovel pit of Nevada Consolidated at Ely, Nevada.

Aug. 7—Quotations of price of silver resumed at London.

Aug. 8—First announcements of impending closing of Cobalt silver mines.

Aug. 10—Beginning of A. I. M. E. meeting at Salt Lake City.—Suit brought against Bullwhacker Copper Co. by some of company officers to recover money advanced.

Aug. 12—Three men suffocated while fighting fire at Big Ben mine, Kern County, Calif.

Aug. 14—Jacob Langeloth, chairman of board of directors of American Metal Co., died.—Operations suspended in Czar and Holbrook shafts of Copper Queen; 400 men dismissed.

Aug. 15—Constitutionalists entered City of Mexico.—Cananea closed down.

Aug. 20—Open quotations of prices for sheet zinc withdrawn by the manufacturers.

Aug. 22—Smoot bill for silver purchase passed Senate.—Quotations of price of silver resumed at New York.

Aug. 26—Beginning of high-handed regulation of Butte labor by Butte Mine Workers' Union.

Aug. 30—Alleged rebel miners dynamited Anaconda company's employment office at Parrot mine.

SEPTEMBER

Sept. 1—Calumet & Hecla passed quarterly dividend. Mine production curtailed and wages and salaries cut.—Resignation of Messrs. Kinzie, Kennedy and Lass from Treadwell group.—Martial law declared in Butte.

Sept. 7—Announcement of President Wilson's terms of settlement offered Colorado coal miners and operators.

Sept. 8—All but one (Davis-Daly) of Butte mining companies joined in declaration against closed shop.—Nevada Consolidated and Ray passed dividends; Chino cut.

Sept. 9—Muckie McDonald arrested in Butte.

Sept. 12—James B. Haggin died.—Announcement of gold strike north of Tonopah.—Explosion at Ralph's coal mine, Huntly, N. Z., resulted in loss of 43 miners.

Sept. 16—Petition in bankruptcy filed in New York against Ohio Copper Co.

Sept. 17—Eleven men caught and killed by cave-in at Centennial-Eureka mine, Eureka, Utah.—Volcanic eruption at White Island, Bay of Plenty, N. Z., resulted in serious loss of life, the sulphur property of the New Zealand Sulphur Co. being buried.

Sept. 18—Three men killed by fall of ground in bottom of prospect shaft at Maiden Rock, near Butte.

Sept. 19—Interstate Commerce Commission reopened railroad-rate case.

Sept. 22—Anaconda cut dividend.—Job office of Tonopah Bonanza blown up.

Sept. 23—Villa broke with Carranza.—New Texas School of Mines at El Paso opened.

Sept. 26—Committee of Safety of the City of Butte organized with between 300 and 400 members.

Sept. 30—Announcement of first shipment to Canada by gold pool.

OCTOBER

Oct. 1—Phelps-Dodge introduced company-store profit-sharing plan for employees.—El Oro company resumed operations on small scale after five months' shutdown.—Cave-in at American Davey mine, in Joplin district.

Oct. 2—First withdrawal of militia from Butte.

Oct. 6—Duncan deposed as mayor of Butte.

Oct. 8—Pittsburgh meeting of A. I. M. E.—Montana supreme court rendered decision to effect that military courts in Butte were illegal.

Oct. 12—Boer commando mutinied in South Africa.

Oct. 14—Dunbar blast furnace of American Manganese Manufacturing Co. blown in, using Cuyuna iron-manganese ores.

Oct. 16—Additional withdrawal of militia from Butte.—Cloudburst in southeastern Missouri did great damage to railroads and mines.

Oct. 17—Mason Valley suspended operations.

Oct. 18—Butte & Superior closed down.

Oct. 19—Fire broke out in Mexican mine on Comstock, soon controlled.—St. Joseph Lead Co. announced curtailment of 25% in output of lead.—News of curtailment by Cœur d'Alene mines.

Oct. 20—Alaska coal-land leasing bill signed by President.

Oct. 21—Settlement of Silver King Coalition-Silver King Consolidated suit by compromise, each company getting certain claims.

Oct. 22—First active buying of copper since July.

Oct. 23—War-tax bill signed by President.

Oct. 26—Bullwhacker stockholders accept reorganization plans.

Oct. 27—Generals De Wet and Beyers revolted in South Africa.

Oct. 28—Completion of permanent organization of California Metal Producers' Association.—British detain three ships carrying copper to Italy, and two going to Scandinavia.—Italy reported to have put embargo on copper export to Germany.

Oct. 30—Colonel Maritz, rebel leader in Cape Province, beaten and driven out of colony.

Oct. 31—Copper at 20c. per lb. in Germany.

NOVEMBER

Nov. 1.—"Engineering and Mining Journal" resumed quotation of copper market.

Nov. 3—Election Day—Arizona accepts prohibition and 80%-native-labor laws.—Montana defeats workmen's compensation measure.—Socialist defeat in Butte.—England holds copper shipped to Italy on American vessels.

Nov. 5—First trial run of Jones furnace at Marquette.

Nov. 7—Beginning of sanitary survey of Joplin district by U. S. Public Health Service and U. S. Bureau of Mines, with object of combating miners' phthisis.—Missabe docks at Duluth close.

Nov. 9—New York Metal Exchange reopens.—London Metal Exchange reopens.—Caving shaft at Sibley mine of Oliver Iron Mining Co. on Vermilion range, Minn., catches six men, of whom only one is later taken out alive.

Nov. 10—British ambassador at Washington reports that Italy prohibits export of copper, but does not prevent transit to neutral countries over Italian territory.

Nov. 11—Curb market resumes open and unrestricted trading with permission to publish prices.

Nov. 12—Demand sterling at 4.86¾, lowest since April.—Final withdrawal of troops from Butte.

Nov. 16—Federal Reserve banking system inaugurated.—Conviction of Boris Thomasen, member of I. W. W., for arson, following confession of having helped to set recent fires in Tonopah and Goldfield.—Gary steel mills increase operations.

Nov. 18—First distillation furnace fired at Langeloth, Penn.

Nov. 22—Muckie McDonald and Joe Bradley convicted of kidnapping.

Nov. 28—New York Stock Exchange opens for bond trading at minimum prices.—Formation of Safety and Sanitary League in Joplin, Mo.

Dec. 1—Announcement that M. A. Hanna & Co. will sell Great Northern iron ore.—Final war-tax measures effective.

Dec. 5—New York Stock Exchange permits stock trading with minimum prices.

Dec. 7—Seventeenth annual meeting of the American Mining Congress in Phœnix, Arizona.

Dec. 8—Report of Selby Smelter Commission filed with superior court of Solano County, Calif.; favorable to smelting company.

Dec. 12—International Hotel burned at Virginia City, Nevada.

Dec. 15—Case to test constitutionality of 80% law begun in Federal court at Tucson, Ariz.—Formation of Michigan Equal Tax Association at Marquette to fight tonnage-tax proposal.

Dec. 16—General increase in freight rates on lead and spelter from St. Louis to Eastern points.

Dec. 19—Butte & Superior resumed milling.

Dec. 24—Memorandum from Washington to London requesting readjustment of system of searching and detaining American shipments.—Isle Royale mill burned to ground in Michigan copper country.

Dec. 27—Death of Charles Martin Hall, inventor of process of aluminum smelting in general use.

Dec. 31—Surrender by Steel Corporation of its lease on the Hill iron-ore lands on the Mesabi range.

Mining Stocks in 1914 in New York

The accompanying tables show the 1914 quotations on mining stocks listed in New York. The Exchange was closed from July 31 until early in December.

NEW YORK CURB TRANSACTIONS

Sales	Stocks	Open	High	Low	Last
935,000	*Atlanta	24½	60	24½	52
55,700	*Beaver Cons	30	33	18	22
195,250	Blue Bell	5	11	4⅝	6⅝
56,700	*Big Four	12½	16	6	7
40,185	Boston Montana	5½	10½	5½	9⅝
223,215	Braden Copper	7	9⅞	4⅞	6⅞
143,381	Brit Col Copper	2⅛	4⅛	1¼	1⅝
700	Barnes-King Dev	1¾	1¾	1¼	1¼
68,975	Buffalo Mines	1⅞	2¼	⅞	⅞
3,200	*Butte & London	34	36	34	34
8,300	Butte-New York	⅞	1⅜	⅝	¾
100	Butte & Superior	38½	38½	38½	38½
35	Calum & Ariz	65½	65½	65½	65½
20,000	Can Cop Corp	2¼	2⅞	1¼	1½
268,300	Can Gold Silver	19	10½	3½	8
202,048	*Caribou Cobalt	68	73	60	63
172,600	C O D Cons	5	14	4	8½
102,700	*Comb Fraction	11	20	10	11
114,038	Con Ariz Smelt	⅛	⅝	⅛	⅜
18,400	Con Copper Mines	2½	3⅛	1½	1⅝
67,750	Con Nev-Utah	⅜	⅜	⅛	⅛
2,940	Copper Mines	1⅜	1⅜	1⅛	1⅛
103,150	*Crown Reserve	1⅞	1⅞	63	1½
9,710	Davis-Daly Cop	2	2⅝	½	⅝
74,500	*Dia Field Daisy	4½	7	4	6½
108,210	*Dia Black Butte	4	10	2	6½
6,230	El Paso Con	2⅞	2⅞	1⅛	1⅝
2,300	*Ely Cent	3	3	3	3
113,000	*Ely Consol	4½	7	2½	5
25,100	*Eureka Cons	3	7	3	7
2,637	First Nat Copper	3½	3½	1⅞	1⅞
265,900	*Florence	25	1⅛	24	67
400	Giroux Mining	1½	1½	½	1
239,600	*Gold Hill	20	⅞	20	⅝
1,622,485	*Goldfield Cons	1⅞	2½	89	1⅛
400	Greene-Can Cop	10	10	10	10
62	Greene-Can Cop, old	6½	6½	5½	5½
23,575	Greene-Can Cop, new	30	42½	21	28
44,200	*Goldfield Merger	41	42	36	32
369,862	*Greenwater C M & S	15	7½	4½	5
9,800	*Halifax Tonopah	1¼	1¼	24	34
76,460	*Int. Mines Dev	28	35	21	30
1,830,300	*Jumbo Ext	14	4	13	2½
127,802	Kerr Lake	3 7/16	6	3 7/16	4½
7,000	*King Edward	2	4	2	4
123,300	*Kewanas	20	35	20	30
200	Keystone Mining	1½	1½	1½	1½
72,220	La Rose Consol	1⅛	2	½	½
13,100	*Lone Star	10	16½	10	14
5,517	Mason Valley, new	3½	3¾	2½	2⅝
256,247	*McKinley-Dar	1	1⅛	44	55
24,700	M. Co. of Am., new	2¼	3¼	2¼	2½
500	*Mutual Min. Co	50	50	50	50
7,370	Mut. M. & Ls. pf	1	2⅜	1	2½
131,670	*Nevada Hills	45	61	20	30
200	Nevada Wonder	1⅜	1⅜	1⅜	1⅜
40,450	*New Utah Bingham	40	69	36	61
16,500	New Utah	⅜	⅜	⅜	⅜
151,962	Nipissing M. Co	7⅜	8 7/16	5⅜	6 7/16
8,600	No Butte Develop	3/16	⅜	1/16	1/16
4,650	Ohio Copper	1/16	1/16	1/16	⅛
1,355,975	*Oro	10	21	5	13
34,700	Pacific Smelters	⅛	⅞	3/32	⅛
5,675	South U. M. & M	¼	¼	¼	¼
84,760	Stand Silver-L	1½	1½	1½	1½
243,835	Stewart	1½	1⅝	1	1 7/16
1,900	Stewart M. tr. ctfs	1 5/16	1 5/16	1 3/16	1 5/16
300	Tonopah-Belmont	7½	7½	7½	7½
597,940	*Tonopah Merger	52	72	26	36
106,043	Tonopah Ext	1⅞	3	1⅜	2 1/16
14,728	Ton M. of Nev	6⅜	7 15/16	5½	7½
30,600	Tularosa	⅜	⅞	3/32	⅛
1,300	Tri-Bullion	3/32	⅛	1/16	1/16
16,515	*Tuolumne Copper	55	87½	23	24
2,000	*Union Mines	5	6	5	6
200	Union Copper	⅜	⅜	⅜	⅜
1,200	United Verde Ex	1½	2 9/16	1½	2
467,051	*West End Cons	1 5/16	1⅜	46	57
267,300	*West End Ext	3	5	1	3
14,900	*Wettlaufer S. M	4	8	4	7
774	Wh. Knob Cop. pf	¼	1⅜	¼	1⅜
14,480	Yukon Gold Mines	2 1/16	3⅛	1⅞	2¼
Total shares 1914					11,004,172
Total shares 1913					10,576,792

BONDS

2,500	Braden Copper 6s	160	160	130	130
10,000	Braden Copper 7s	167	167	160	163
2,700	Can. Cop. deb. 6s	80	80	55	55
90,000	Chile Copper 7s	112	112	107	110½
6,000	Mason Valley 6s	60	60	53	53
13,000	Va-Car Chem 6s	104¼	104¼	100⅛	101¼
Total 1914					$124,200

*Cents per share.

STOCKS ON THE NEW YORK STOCK EXCHANGE

Sales		—Highest—		—Lowest—		Closing	Net Change
429,700	Alaska Gold Mines	28⅞	May 18	19½	July 30	26⅞	+ 5⅜
37,940	Allis-Chalmers Co	14¼	Feb. 20	6	July 30	8	— 1
19,125	Allis-Chalmers Co. pr	49	Jan. 26	32½	July 30	36	— 7
3,002,550	Amalgamated Cop	78⅛	Feb. 4	48¼	Dec. 24	51⅞	—21⅞
351,280	Am. Smelting	71⅛	Feb. 4	50½	July 30	56½	— 8
29,085	Am. Smelting pr	105	Jan. 27	97½	Apr. 25	99½	+ ⅞
2,670	Am. Smelters pr. B	85	Jan. 19	79½	July 28	79½	— 2½
274,300	Anaconda	38½	Feb. 3	24½	Dec. 23	25⅛	—10⅜
10,900	Batopilas Mining	1¼	Feb. 10	½	Apr. 24	¾	— ½
265,750	Bethlehem Steel	46⅜	Dec. 31	29½	Jan. 2	46⅜	+16⅜
39,950	Bethlehem Steel pr	91⅞	Dec. 31	68	Jan. 10	91½	+27½
466,300	Chino Con. Cop	44	Feb. 4	31⅝	Dec. 24	33½	— 6
125,200	*Comstock Tunnel	10	Feb. 16	5	May 1	6	— 2
925	Federal Mining & Smelting	15	Jan. 24	7¼	May 2	10	— 1
7,154	Federal Mining & Smelting pr	43	Jan. 27	28⅝	Dec. 30	28⅜	— 7½
1,225	General Chem. Co.	180	Jan. 23	160	Apr. 27	167	—13
2,286	General Chem. Co. pr	110	June 15	107½	Feb. 2	108½	+ 1½
130,600	Great Northern Ore subs	39¼	Jan. 19	22½	July 30	27	— 7½
155,895	Guggenheim Exp	57½	April 2	40½	July 30	45	+ ⅜
2,860	Homestake	120½	Mar. 14	109½	July 29	110	— 6
128,070	Inspiration Cop	19¼	July 16	14½	July 30	16½	+ 1½
5,054	Lackawanna Steel	40	Jan. 26	26½	July 30	28	— 2
121,625	Miami Cop	24⅜	Feb. 16	16½	Dec. 12	17½	— 4⅜
9,690	National Lead	52	Jan. 26	40	July 29	43½	— 1½
5,300	National Lead pr	100	Feb. 18	105	Jan. 13	107½	+ 3½
147,500	Nevada Con. Cop	16½	Jan. 22	10½	July 30	11⅞	— 3½
4,530	Ontario Silver	2⅞	June 8	2¼	May 25	2¼	— ⅛
3,400	Pittsburgh Steel pr	93	Feb. 3	82	Dec. 23	80	— 6⅞
6,540	Quicksilver	2⅞	Jan. 28	⅞	June 24	1¼	— ⅛
4,780	Quicksilver pr	4	Jan. 27	1½	June 3	1½	— ⅜
351,600	Ray Con. Cop	22½	April 3	15	Dec. 23	15⅞	— 3
138,600	Rep. Iron & Steel	27	Jan. 27	18	Dec. 12	18¼	— 1⅞
33,084	Rep. Ir. & Steel pr	91½	Mar. 11	75	Dec. 16	75	— 5½
9,595	Sloss-Sheffield Steel & Iron	35	Jan. 23	19½	July 30	23	— 5
647	Sloss-Sheffield Steel Iron pr	92	Jan. 30	85	May 22	85	— 4
204,150	Tennessee Copper	36¾	Feb. 11	24¾	July 30	32¼	— 1
100	U. S. Reduction & Refining pr	3	Jan. 12	3	Jan. 12	3	.....
111,690	U. S. Steel	67½	Jan. 31	48	Dec. 23	49⅜	— 9½
134,500	U. S. Steel pr	112⅜	Jan. 31	103½	Dec. 24	104½	— 1½
708,100	Utah Copper	59⅜	June 22	45⅞	July 30	49½	—1
4,150	Virginia Iron Coal & Coke	52	Mar. 10	35	July 28	37	+ 1
505	Vulcan Detinning pr	35	Feb. 10	21	May 8	21	—42

Necrology

Among the noted men identified with the mining and metallurgical industries who died during 1914 were the following:

Arents, Albert	May 13	Heinze, F. A	Nov. 4
Barlow, Alfred E	May 29	Janin, Louis	Mar. 6
Bratnober, Henry	Sept. 14	Langeloth, Jacob	Aug. 14
Christy, S. B	Nov. 30	Potter, William Bleecker	July 13
Cooper, James B	Feb. 27	Sellwood, Joseph	Feb. 24
Frasch, Herman	May 1	Swank, James Moore	June 21
Grier, T. J	Sept. 22	Thum, Frederick A	Sept. 9
Grothe, Albert	Aug. 19	Winchell, Newton H.	May 9
Haggin, James B	Sept. 12		

The Metallurgy of Lead in 1914

By H. O. Hofman*

The August meeting of the American Institute of Mining Engineers, held at Salt Lake City, Utah, formed the occasion for bringing out a large amount of information on the details of the practice of lead and of silver-lead smelting and of refining. It forms thus a landmark for lead as did the meeting of the preceding year at Butte, Mont., for copper. Innovations in all the branches of the metallurgy of lead have thus been put on permanent record.

Roasting Ore

Since the days of Plattner, it is known that in roasting PbS there are obtained PbO and $PbSO_4$; Demwolff, who studied this question (*Metall und Erz,* 1914, Vol. 11, p. 619), found that at temperatures below 450° C. there is formed mainly $PbSO_4$, and that in the presence of a catalyzing agent the whole of the PbS can be changed into $PbSO_4$. On the other hand he ascertained that the more the roasting temperature is raised above 450° C., the larger will be the percentage of PbO formed and that above 750° C. the reactions between undecomposed PbS and $PbSO_4$ as well as PbO will liberate Pb which will be oxidized to PbO.

The Hall process (Eng. and Min. Journ., 1913, Vol. 96, p. 35; *Min and Sci. Press,* 1914, Vol. 109, p. 518; *Bull.* 76, M. and M. Soc. of Am., Sept. 30, 1914), which aims to roast sulphide material in such a way as to oxidize the metal without oxidizing the sulphur which is to be expelled as vapor and collected as flour, has not so far been tried with lead sulphide. The early laboratory work on pyritic ore and the results of later large-scale trials at the Balaklala works, Coram, Calif., are very promising. As far as the reactions taking place are understood, there appears to be no reason why lead-bearing sulphide should not be amenable to the process as are iron and copper sulphides.

Blast-roasting of lead-bearing mixtures has increased to such an extent that it has made almost obsolete the older modes of oxidation. With this growth of the process different apparatus have been used; the two great rivals are the Huntington-Heberlein pot and the Dwight-Lloyd straight-line machine. The results of W. W. Norton (*Bull. of A. I. M. E.,* August, 1914, p. 1993) at the Murray smeltery near Salt Lake City, Utah, and G. C. Riddell (*op. cit.,* November, 1914, p. 2744) at East Helena, Mont., obtained with both devices in two important works of a single company are therefore of greatest interest. Without going into details they may be summarized by the following statement:

Item	Advantage Lies At Murray with	Advantage Lies At East Helena with
Cost of installation	D. & L.	D. & L.
Cost of roasting	H. & H.	Even
Adaptability to charge	D. & L.	D. & L.
Metal loss	Even	Even
Physical condition of product	H. & H.	D. & L.

The data of G. C. Riddell and a discussion by A. S. Dwight (*op. cit.,* November, 1914, p. 2741) bring out the fact, also experienced at Herculaneum, Mo., that blast furnaces running with D. & L. material require less coke than when they carry the product of the H. & H. pot.

Smelting and Converting

The furnaces of the different smelteries of the country resemble one another much in their general aspect; there are, however, considerable differences as regards details of construction and of manner of operating. J. A. Palmer (*Bull. of A. I. M. E.,* July, 1914, p. 1447) brings out some of the leading features. The cross-section at the tuyere-level is 42-46 by 130-160 in. Steel water jackets are replacing those of cast iron; the flare of jackets and of shaft-walls above is much smaller since the charges are made up largely of blast-roasted material. The use of this material has not only greatly increased the smelting power of a furnace, but has done away with the dirt troubles experienced with charges made up of coarse and fine ores, especially when of different chemical composition as is usually the case. The chemical composition of the slag to be made, which used to be the main consideration, has been supplemented by other points of view, such as formation temperature, fluidity and cost. Formerly low lead-contents of slag and matte produced were the leading guides for good work; since the introduction of the baghouse which recovers dust and fume from the gases passing off at the throat, it has been found that the over-reduction furnishing slag and matte carrying little lead created considerable loss at the throat; at present both sources of loss receive the attention that is due them; daily assays of fluedust in addition to those of slag and matte give indications of the degree of reduction taking place in the furnace.

The lead-content of a blast-furnace charge is usually about 15%. The silver-lead furnaces of East Helena, Mont., and the lead furnaces of Herculaneum, Mo., carry as much as 40 Pb on the charge; such a lead content demands special attention of the furnaceman if he is to succeed in recovering values to a satisfactory degree.

The East Helena works (R. L. Newhouse, *Bull. of A. I. M. E.,* August, 1914, p. 1801) treats galena concentrates from Idaho with siliceous silver-gold ores and produces, with three furnaces in operation, 6000 tons of lead bullion per month. The sulphide ore is blast roasted in Huntington-Heberlein pots and Dwight-Lloyd sintering machines. The Huntington-Heberlein division has four Godfrey rough-roasters and 12 pots of 12 tons capacity, and treats 300 tons charge per day; the Dwight-Lloyd division has six machines with pallets 42x264 in., each machine with a capacity of from 90 to 120 tons charge per day. The three blast furnaces in operation are 48x136 in. at tuyeres and 18 ft. high, a fourth is held as reserve. A furnace treats per day 220 tons charge with from 30 to 40% lead with 33 oz. blast pressure. A typical charge consists of Huntington-Heberlein product 36.5 and Dwight-Lloyd 52.6%, carrying 12.92% coke (or 10.1% fixed carbon); it contains Pb, 31.9, and S, 3.8%. There are 15.4 parts of foul slag resmelted. The slag made shows: SiO_2, 33.2; FeO, 31.9; MnO, 2.6; CaO, 18.4; MgO, 2.1; Zn, 5.0; Pb, 0.90%; Ag, 0.30 oz. per ton. The matte, of

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which 14.1% is formed, contains: Pb 13.4; Cu 9.7%; and Ag 18.7 oz. per ton. Gases from the blast roasting and smelting divisions are passed through baghouses.

The works of Herculaneum, Mo. (ENG. AND MIN. JOURN., 1914, Vol. 98, p. 900), treat Missouri galena. The concentrate with Pb 64 to 75% is blast roasted in eight Dwight-Lloyd machines with pallets 42x264 in. to a sinter with Pb, 45 to 50; SiO_2, 12 to 15, FeO, 17 to 21; S, 4 to 5; Ca(Mg)O, 4 to 5%, smelted in four blast furnaces, 42x192 in. at tuyeres and 17 ft. high, at the rate of 225 tons charge per furnace per day, with 12.5% coke and 30 oz. blast producing 90 tons of pig lead. The slag aimed at contains: SiO_2, 33; FeO, 36; CaO, 14.5; MgO, 4; Al_2O_3, 3%; in addition there are present S, 2; Zn, 4; and Pb, 1.2%. The first matte produced containing 3% Cu is rough-roasted in an oil-fired Holthoff furnace, 36 ft. in diameter, at the rate of 40 tons in 24 hr., and in a seven-hearth Wedge furnace at the rate of 60 tons, with a sulphur reduction of from 24 to 12%; it is worked into the sinter charges and smelted until its copper-content has reached 7%, when it is treated alone. The lead is run from the well of the blast furnace through a swinging trough into molds held in a casting wheel; the rough bars are liquated in four reverberatory furnaces, the lead is collected in two 30-ton kettles, poled, and siphoned into molds held in two casting wheels. The gases from the blast furnaces and the refinery pass through a baghouse.

TREATMENT OF MATTE

The two processes of concentrating-smelting and converting have undergone some changes. In the first, the usual method of comminution by crushing is being replaced by granulating. This has been the practice at El Paso (ENG. AND MIN. JOURN., 1914, Vol. 98, p. 465) for a number of years; it is being introduced at Herculaneum where the matte from the forehearth will be tapped into a ladle, transferred by an electric crane to a barrel-shaped tilting storage-furnace, as is converter copper in some copper smelteries, and granulated.

The success attained at the Midvale works near Salt Lake City, Utah, with the seven-hearth Wedge furnace in roasting matte without the use of carbonaceous fuel (L. D. Anderson, ENG. AND MIN. JOURN., 1914, Vol. 98, p. 51) has been the incentive for other plants to do the same. The success is due to the innovation of providing the upper four roasting hearths with multiple-outlet dampers through which the hot gas from each hearth can be made to pass directly into the flue instead of forcing it to travel upward in the usual way. In this manner a complete control of temperature has been made possible. In running the furnace it has been found necessary to have as little draft as is possible; thus the water-depression in the main flue is 0.1 in., on the first and second hearths it is 0.035 in., on the third 0.040, and on the fourth and fifth hearths even less; the two lower hearths are open and serve as coolers. The furnace treats 75 to 80 tons of matte in 24 hours.

In converting, the silica-lined vessel of Omaha has had to yield to the basic converter, and with this vessel the feeding of siliceous ore to slag the iron has been given up at the Tooele works of the International Smelting Co. (Kuchs, *Bull. of A. I. M. E.*, July, 1914, p. 1752). Here there are in operation five basic barrel converters with shells 96x150 in., three for lead matte and two for copper matte; the gases from lead converters go through a baghouse, those from the copper converter through a flue to a chimney. Ten tons of lead matte are poured into a converter and blown in two hours; lead and zinc are oxidized and pass off with the fumes. Most of the iron and some of the copper are oxidized and transferred to a copper-matte converter, where the iron is scorified by additions of siliceous ore, and the oxidized copper sulphurized; the copper charge is then finished in the usual way. The advantage of this mode of treatment is that the lead blast furnace is not forced to treat the large amounts of iron-lead slags formed in the ordinary practice, and has to work up only the fume collected in the bags.

BAG FILTRATION

Bag filtration of gases from furnaces treating lead-bearing materials has become almost universal practice. Gases from blast roasting and converting contain enough metal to pay for recovery by filtration, those from blast furnaces with charges containing little lead may or may not make the operation profitable. The baghouse, however, serves as a safety apparatus and has therefore been installed at most large plants in spite of the large cost of installation and of operating.

H. H. Alexander (*Bull. of A. I. M. E.*, August, 1914, p. 2001), in a paper on the subject, shows how the formation of SO_3 in converting can be reduced to a harmless percentage if the gases are diluted by air and cooled to a temperature that is too low for the formation of the corroding SO_3. Nevertheless most plants use the more expensive woolen bags, as their greater resistance to heat and sulphurous gases renders them cheaper. L. D. Anderson (*Bull. of A. I. M. E.*, July, 1914, p. 1689) records experiences of the Midvale works. Here the SO_3 in the gases is neutralized by additions of calcium and zinc oxides; stress is laid in having the gas pressure in a bag low, that is 1 to 2 in. water; the bags are freed from dust by replacing the pressure with a vacuum and repeating this change two or three times every eight hours. The blast-furnace dust, carrying As 35 to 45%, is collected in hoppers, transferred by screw-conveyors to cars and treated in an arsenic-plant; the dust from the blast-roasters, As, 9 to 16%, is briquetted and added to the blast-furnace charges. If dust contains over 45% As, there is danger of self-ignition.

The Cottrell electric precipitation is in successful operation at the Garfield smeltery (Howard, *Bull. of A. I. M. E.*, August, 1914, p. 2029) collecting the lead fumes from the copper matte converters. At Anaconda (E. M. Dunn, *Bull. of A. I. M. E.*, November, 1914, p. 2738) it has been found that fractional precipitation of vapors is feasible by regulation of temperature and speed of gases. Schiffner (*Metall und Erz*) has succeeded in collecting antimonious oxides by electric condensation.

DESILVERIZING

The most notable event is the starting of the lead refinery of the International Smelting & Refining Co., at East Chicago, Ind. (H. P. Hulst, *Bull. of A. I. M. E.*, August, 1914, p. 1865, November, p. 2749.) Here the lead bullion from Tooele, Utah, is desilverized by the Parkes process, and part of the refined lead freed suffi-

ciently from bismuth by the Pattinson process to make it available as corroding lead. The plant, which treats 200 tons of lead bullion per day, is modern in its equipment for handling materials. Lead which is not to be sampled is conveyed from the cars mechanically into two softening furnaces which have a capacity of 300 tons, that which is to be sampled is melted in two kettles of 45 tons capacity. There are two 100-ton desilverizing kettles, one 300-ton refining furnace, and one 200-ton reverberatory molding furnace. Besides there are two 30-ton residue reverberatories for drosses and skimmings; two water-jacket blast furnaces, 42 in. in diameter and 14 ft. high, for treating antimony- and silver-bearing intermediary products; eight retort-furnaces with 1300-lb. retorts; and two Rhodes cupeling furnaces with tests of 5 tons capacity. The Pattinson division contains two 60-ton crystallizing and four 20-ton heating kettles, and one Hulst press. The mode of operating the Parkes plant is the usual one; by Pattinsonizing the bismuth content of the refined lead 0.08 to 0.12% is reduced by a single crystallization and the assistance of the Hulst press to 0.08 to 0.05 per cent.

An innovation in the treatment of the refining skimming, obtained in freeing from zinc lead desilverized in the Parkes process, has been devised by R. D. Divine (*Bull. of A. I. M. E.*, August, 1914, p. 1877) and put into operation at the lead refinery of South Chicago. The process consists in crushing the skimming to ½ in., mixing with finely pulverized oil-coke and soda ash, and smelting in an oil-fired reverberatory furnace at 1000° C. on a bath of lead. From 80 to 85% of the zinc is burned off and collected in a baghouse; the lead and antimony go into the metal bath; the baghouse fume is electrolyzed at Omaha furnishing a high-grade spelter; and the soda slag is smelted in the blast furnace treating antimony skimming.

The Metallurgy of Copper in 1914

By Lawrence Addicks*

The condition of the copper market, none too good during the first half of 1914 and simply chaotic during the second, forced such a curtailment in production upon the industry that metallurgical progress had not the steady onward sweep characteristic of recent years, advances having been confined to more or less restricted fields. The war situation has caused every plant to run under abnormal conditions and some, notably the great smeltery at Great Falls which has contributed so much to the metallurgy of copper, have shut down completely. The result is that progress has in most departments to be stated in general terms rather than by pointing out specific achievements.

New construction has been similarly affected and while no plants under actual construction have been abandoned, work is proceeding at a much slower rate and contemplated extensions to existing plants, such as that to the Great Falls electrolytic refinery, have been laid over to await better times. One notable contribution to smelter construction work has been made by the publication[1] in the most systematic detail of the construction costs of the large new plant of the Arizona Copper Co. The transactions of the American Institute of Mining Engineers continue to be rich in the records of copper practice and easily the most comprehensive book yet published on modern copper metallurgy[2] has been issued by Professor Hofman during the year.

Ore Dressing

A growing tendency toward simplification of concentrator flow sheets is evident and it is safe to say that the concentrator of the future will be more compact. This simplification is being brought about, first, by the use of a less elaborate system of classification, resulting in the elimination of some of the screens and jigs, and second, by the realization that a gravity concentrator is but a relatively inefficient mechanism at best and that higher recoveries can better be obtained by following the concentrator proper with some other process such as flotation or leaching rather than by increasing the internal complexity of the old-style mill.

The court decision[3] whereby certain of the patents controlled by the Minerals Separation Co. were not held to bar the public use of the general flotation principle, resulted in a greatly increased interest in the possibilities of this process for retreatment of concentrator tailings, and experiments are under way wherever the values now lost lie chiefly, if not entirely in sulphide minerals. As yet there seems to be no simple set of ordinary chemicals to be counted on for effective work, a great range of more or less expensive organic compounds entering into most experiments. It is this cost of chemicals, given a suitable mineral, which will probably determine the ultimate scope of flotation.

Leaching attacks the problem from a very different point of view. Oxidized minerals are readily attacked and in most cases a direct recovery of electrolytic copper is contemplated. It is in the handling of the precious metals that leaching is handicapped, but these are often present in tailings in but negligible amounts.

In a general way, therefore, flotation and leaching are in competition for the handling of concentrator tailings and it is quite possible that ultimately the field will be divided between them; the net result being a greater total recovery and a simplified preliminary concentration. This is of especial interest in the case of some of the so called porphyry operations where success has been obtained in low-grade ores by using very cheap mining methods and handling enormous tonnages rather than through high recoveries. It is quite possible to consider overall recoveries from a low-grade ore of over 90% with a concentration-leaching combination.

Leaching

Leaching is now having a thorough trial in Montana, Arizona, Michigan and Chile on problems differing widely in their nature. Only one of these trials, namely that

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[1]"Bull. of A. I. M. E.," July, 1914, p. 1497.
[2]"Metallurgy of Copper," McGraw-Hill Book Co.
[3]"Eng. and Min. Journ.," Vol. 97, p. 1067.

at Anaconda, involves the recovery of silver; here salt is added to the leach liquor and the products go to an ore reverberatory. In the other cases the direct recovery of cathode copper is contemplated. In all but one case, that of the Calumet & Hecla, sulphuric acid is the active leaching agent. The native Lake copper is to be dissolved by an ammonia process. At Anaconda and Douglas, roasted sulphides are handled; at Butte, silicate; at Ajo, Arizona, carbonates and oxide; at Lake Linden, Michigan, native copper; and at Chuquicamata, Chile, oxy-sulphate. At Anaconda concentrator sand tailings are to be treated; at Douglas, sands, slimes and part of the concentrates; at Lake Linden stamp tailings; and at Ajo, Butte and Chuquicamata, ore. Such a varied set of conditions calls for an equally varied application of leaching processes and no one plan will fit all cases. It is probable, however, that this work will so develop the general methods of handling individual parts of the problem that a much wider field, involving complex ores, may be intelligently attacked.

Regarding some of these experiments not much has yet been made public. Concerning the Anaconda[4] and Chuquicamata[5] processes ample data are available. The whole problem is believed to be of so much importance that a brief recapitulation of the various plans is given below.

At Anaconda the concentrator sands carry about 12 lb. of copper and 0.55 oz. of silver to the ton. An 80-ton test plant gave such satisfactory results that a 2000-ton-a-day unit is under construction. The sands are roasted in an externally fired MacDougall, giving about 930° F. with 2½% of coal. The hot calcines are cooled in a rotary water-cooled drum and delivered to percolation tanks where they are leached with byproduct sulphuric acid and salt. The copper is eventually to be precipitated upon sponge iron to be made from a concentrator product. It will be noted that this operation is very similar in its result to flotation, the final product being practically a concentrate minus its sulphur.

At Butte the Butte Duluth Mining Co.[6] is surface mining a low-grade (perhaps 2½% copper) ore, the mineral being chrysocolla with some carbonates and the gangue chiefly silica. The ore is crushed to about 10 mesh and leached with sulphuric acid in modified Dorr classifiers. The slimes are taken to a Dorr thickener followed by a Kelly filter-press. The sands are carried to successive classifiers used as washing machines. The stronger solutions are electrolyzed with lead anodes and the weaker precipitated upon scrap iron. It will be seen that this is a direct application of cyanide machinery to copper-leaching work.

At Douglas, Phelps Dodge & Co. has installed a 75-ton test plant after conducting considerable research work, designed primarily to try out leaching on the ores of the Burro Mountain Copper Co.[7] at Tyrone, N. M., which is one of its subsidiary companies. The mineral is chiefly a finely disseminated chalcocite in a highly siliceous gangue carrying 10 to 15% alumina. The plan of operation is to give a preliminary concentration, roasting concentrates and tailings separately, leaching both products, sending the leached concentrates calcines with about half the copper extracted to the smeltery at Douglas. The tailings are roasted with fuel oil at about 950° F. in a MacDougall and fed hot through an "hour-glass" to a sluice carrying the leaching liquor and delivering into the first of a series of seven Dorr thickeners. This is an application of the trough lixiviation used years ago in the hyposulphite leaching of silver. Continuous countercurrent washing is employed by means of the thickeners and a part of the wash water is diverted to a cementation plant. The liquor from the first thickener is sent through a "neutralizer" where cement copper from the previous operation reduces any ferric sulphate and is then pumped to the electrolytic cells. Carbon anodes are used and ferrous sulphate employed as a depolarizer. The rate of circulation and composition of electrolyte are adjusted to yield an 80% current efficiency and about 2.5 lb. cathode copper per kw.-hr. are counted upon. The bulk of the ferric sulphate formed in the cells is reduced in an outside tower with sulphur-dioxide gas from roasting the concentrates, yielding sufficient sulphuric acid to balance out the process. In this case it will be noted that cyclical operations have been abandoned, the process being continuous throughout, and that the smelting plant is being utilized to work up the tailings from one operation, the bulk of the copper, however, being recovered as cathodes. These ores carry but negligible quantities of silver and gold, but any present in the concentrates will go to the smelter with these tailings.

At Ajo[8] the Calumet & Arizona Mining Co. controls the New Cornelia mine where there is an immense capping of oxidized ore. Here the relative scarcity of water has some bearing upon the leaching problem and upward percolation is being tried instead of using cyanide machinery. A 35-ton test plant has been erected. In general, a counter-current series of leaches is contemplated with the idea of applying a neutral solution at first, using the oxidized ore to precipitate part of the iron and alumina in the foul solutions. These precipitates appear to be more or less insoluble in the succeeding acid washes. It is planned to electrolyze the solutions and two methods are being tried to handle the impurities—one to oxidize them with roasted concentrates or similar material, somewhat along the lines of the old Hofman process, and the other to ignore them, using sulphur dioxide in the cell as a depolarizer.

At Clifton, Ariz., the Shannon Copper Co. is working on the possibility of sulphatizing lime by mixing oxide and sulphide ores, so as to make possible the sulphuric acid leaching of ores high in calcium carbonate.

At Lake Linden, Mich.,[9] the Calumet & Hecla Mining Co. is installing a mammoth dredge to reclaim the tailings from the lake bed. These sands are to be reground and concentrated. The tailings from this concentration will carry about six pounds of native copper to the ton and are to be leached. On account of a high-lime content making acid treatment costly, a process based on the reaction between copper oxide and ammonia is to be employed. The details of the process have not been made public, but a solution of ammonium carbonate in ammonia water is presumably to be used for the oxygen carrying liquor, successive films of oxide being formed on the particles of native copper and dissolved. The proof of the process will be in whether the regeneration of rela-

[4]"Bull of A. I. M. E.," August, 1914, p. 2165.
[5]"Trans. Am. Electrochem. Soc.," Vol. 25, p. 193.
[6]"Bull. I. M. M.," May 21, 1914.
[7]"Eng. and Min. Journ.," Vol. 98, p. 288.
[8]"Bull of A. I. M. E.," August, 1914, p. 2011.
[9]"Min. and Sci. Press," Vol. 109, p. 361.

tively expensive reagents will be sufficiently perfect when treating such very low-grade material. A 2000-ton plant has been in course of erection.

The largest leaching plant under course of construction is that being built by the Chile Exploration Co., at Chuquicamata, where a 10,000-ton-a-day plant is well on toward completion.

Here there is an enormous surface deposit of brochantite contaminated with salt, which is to be leached with dilute sulphuric acid, the copper being precipitated electrolytically. Owing to the high solubility of the mineral content, a 90% extraction on a 2% ore is made when crushing to ¼ in. Six leaching vats made of reinforced concrete lined with mastic asphalt, 110 ft. wide, 160 ft. long and 16 ft. deep, are placed end to end and the ore from the crushing plant delivered by a traveling bridge. Downward percolation with piston washes is to be used, a leaching cycle taking six days. The tailings are to be removed by grab buckets. The liquor is to be freed from chlorides before electrolyzing by precipitation as cuprous chloride by treatment with shot copper in revolving drums. Magnetite anodes without depolarization are employed in the electrolysis. The cuprous chloride is smelted with lime and carbon to copper and a calcium-chloride slag.

It will be seen from the foregoing that we have upward and downward percolation as well as cyanide machinery at work. The Chuquicamata deposit is unique, however, and for most work fine crushing is likely to be essential to efficient extraction, so that the Dorr thickeners and similar apparatus are likely to see a considerable adaptation and development. The Arizona Copper Co. has a Dorr thickener successfully at work in a tank 130 ft. in diameter which has handled over 1000 tons of solids in 24 hours. In electrolytic work, anodes of lead, carbon and magnetite, with and without depolarizers, are being employed and it seems clear that old-time difficulties with insoluble anodes have been overcome.

Roasting

The use of concrete hearths[10] in furnaces of the MacDougall type is extending. After some experiments they have been employed in the new battery of seven 18-ft. furnaces at the Copper Queen plant. They reduce the masonry repairs and facilitate the removal of incrustations. It is most desirable to minimize the repairs required on account of the serious loss of capacity owing to the time required for cooling down and heating up.

This type of multiple-deck furnace has long been used in this country for the production of sulphur-dioxide gas from pyrites at acid plants and of calcines from sulphide ores at smelting plants. It seems likely that it will hold its own in the third field of producing soluble sulphates and oxides in leaching work. Muffle furnaces for this work have not found as much favor as was at first expected, chiefly on account of high fuel consumption. Attention to delicate temperature control of the charge in the ordinary furnace is now being given by the three makers of the type. It is quite unusual for a single metallurgical apparatus to cover successfully such a varied field of operations.

Where a chloridizing roast is employed, there is a considerable volatilization loss from any open type of furnace and in this connection mention should be made of a shaft roaster, the result of work by Messrs. Holt, Dern and Christensen[11], at Park City, Utah. The present furnace consists of a sheet-iron box or shaft with a cross-section of about 4x4 ft., although larger units are contemplated. At the bottom is a row of oscillating grates and the top is covered by a hinged lid, there being a side outlet to the flue. The charge is perhaps 4 ft. deep and consists of a mixture of ore, coal dust, salt and water, with the possible addition of sulphides, depending upon the character of the ore. About 3% coal is the maximum required. As soon as any glow is perceived on top of the charge, a green charge is added and the oscillating grates continuously deliver ground fritted material at the bottom. The blast traveling upward meets first the hot sinter and is preheated; it then enters the roasting zone; and finally it encounters the moist cool charge on top, where it is cooled and any volatile compounds condensed. It is claimed that the volatilization and dust losses are small and that a product ideal for percolation is made. The furnace is at present running on silver dumps but can be also utilized for copper work, where the recovery of silver values has to be considered.

The rotary kiln at Chrome, N. J.,[12] continues in operation and greater fuel economies are being obtained by means of heavier feeds. Recent campaigns show a ton of flue dust nodulized with eight gallons of fuel oil. Some excellent work has also been done on flotation concentrates, satisfactory nodules being made with six gallons of oil per ton. It seems quite possible to conserve sufficient sulphur to make pyritic smelting in a blast furnace possible and this is of great importance where fuel is so expensive that the cost of reverberatory smelting is excessive. It is understood that the Braden Copper Co. is installing three kilns in Chile for work of this class.

Reverberatory Smelting

Coal-dust firing, which was revived at Copper Cliff with very satisfactory results, has been followed up at Garfield and Anaconda[13] with similar success. At both plants it is to be installed throughout and at Garfield it will replace fuel oil. Apparently the early difficulties from coal ash falling on the charge have been entirely overcome; in fact, the reason for the great improvement over early attempts doubtless lies in the thorough drying and grinding given the coal.

At Anaconda a furnace was especially built for the trial, thereby permitting a revision in the method of charging similar to that practiced at Copper Cliff. The charge is piled high along the sides, obviating the necessity of fettling, and but a very small bath of molten matte is carried. In this way a large smelting area is exposed to the heat, which accounts for the high smelting rate obtained and brings up again the question of the economy of longer furnaces. The trial furnace had a hearth of 21x124 ft. and smelted as high as 550 tons a day, 475 tons being a month's average, with a coal consumption of about 7 : 1, thereby fully confirming the results obtained at Copper Cliff. It is now proposed to build a furnace 25x144 ft., in which it is hoped to smelt 800 tons a day with a coal ratio of 8 : 1.

This advance in practice will have a bearing on the relative economy of blast and reverberatory furnaces.

[10] "Trans. of A. I. M. E.," Vol. 46, p. 383.
[11] "Bull. of A. I. M. E.," July, 1914, p. 1699.
[12] "Bull of A. I. M. E.," July, 1914, p. 1671.
[13] "Eng. and Min. Journ.," Vol. 98, p. 725.

Fuel cost has always been the main item in the operation of a reverberatory plant. In the old days when the ratio was three or four to one, a reverberatory was often out of the question as against a blast furnace running on a coke ratio of 10:1 and advances toward pyritic smelting increased this handicap. Then waste-heat boilers redeemed 25% of the heat value in the coal; and now the coal consumption has been cut in two as against a few years ago. A reverberatory still requires a uniform preheated charge with adjusted sulphur contents, but permits much greater latitude than a blast furnace in the type of slag produced, and it would seem that it will eventually entirely displace the blast furnace in large plants operating chiefly on concentrator products, while the blast furnace, preceded by some type of sintering when necessary, will control the field of smaller plants with variable ore supply or where a more or less oxidized charge has to be smelted.

Blast-Furnace Smelting

No special development in blast-furnace practice has been reported during the year. The closing down of the Great Falls plant cut off any further research on the effect of furnace lines upon the speed of smelting.

Some interesting experiments are being carried out at the Copper Queen plant at Douglas on the possibilities of the McKee boiler for generating low-pressure steam from the waste heat of blast-furnace slag. The stream of slag is granulated and carried into the boiler at the same time by a stream of water acting somewhat as an injector and overcoming the slight pressure of steam in the large drum which constitutes the boiler proper. The granulated slag is continuously removed by bucket conveyor trapped by a water seal. The chief loss of heat is in the hot water entrained with the outgoing slag. The plan is to use the steam generated in low-pressure turbines for the development of electric power. The trials to date indicate the device to be practical as a steam generator, the only difficulty being that some pulverized slag comes over with the steam and this would cut the turbine blades. Experiments are in progress on the possibilities of mechanical separation of these solid particles. One way of escape would be to generate the steam in a separate vessel inclosed in the main boiler. This could also operate turbines running with an inlet pressure slightly below atmospheric and therefore do away with the necessity of trapping the primary boiler openings. A similar conclusion has been arrived at in English experiments on iron slags[14]. There is no reason why a similar scheme could not be applied to reverberatory slag.

The Detroit Copper Mining Co. has erected a 44x396-in. blast furnace at Morenci[15] for the treatment under low blast of a charge consisting chiefly of concentrates, which would generally be considered a reverberatory proposition.

Converting

Practice in basic converting is now standardized and since it has become generally understood that the durability of a basic lining depends upon maintenance of a protective coating of magnetite, practically unlimited tonnages are obtained from a single lining. The vertical shells continue to be used in new installations in preference to the horizontal type.

[14]"Eng. and Min. Journ.," Vol. 98, p. 290.
[15]"Eng. and Min. Journ.," Vol. 98, p. 201.

Fume Condensation

A great deal of work is being done in the field of abating the smelter-fume nuisance, perhaps the greatest progress being along the line of electrostatic precipitation. Practically all new flue installations are being equipped with suspended wires to collect the bulk of the solids. The bag house can be relied on to collect practically the whole of the remaining solids, but the high installation cost, coupled with that of neutralizing agents to protect the bags, have militated against its use where widely varying acidity is to be dealt with, as in the use of copper-converter gases. At Garfield[16] a series of exhaustive experiments with the Cottrell system has been carried out and a plant to treat all the converter smoke has been made part of the new flue extension. A new type of pipe electrode was developed and over 95% average clearance of gases proved practicable. Also promising results on fractional precipitation of different impurities were experimentally obtained by using treaters in series, with appropriate temperature drops. At Anaconda[17] experiments are in progress to develop a cheaper type of Cottrell installation, using larger pipes for the electrodes.

The experiments being carried out at Coram, Calif., on the Hall[18] process of roasting sulphides with producer gas or fuel oil, with the consequent recovery of elemental sulphur and corresponding elimination of sulphur dioxide from the fumes, have been very interesting. Unfortunately the breaking out of the war put a stop to the experiments just when very promising results were being obtained.

Indirectly, leaching concentrator tailings and utilizing the sulphur dioxide from roasting the concentrates in the subsequent electrolysis may be considered as a contribution toward fume condensation.

Refining

Considerable attention is being paid at the present time to improvement in refining-furnace design. For smelting very foul material with the production of high-grade anodes the basic furnaces at Chrome seem to have fully justified their higher first cost. The demands made upon basic brick are resulting in improvement in their quality. It is understood that at least one of the large manufacturers is installing machinery for molding magnesite shapes under heavy pressure in accordance with foreign practice. It is also to be hoped that suitable domestic sources of magnesite will be developed so as to lower the still relatively high cost of such brick.

Narrower and longer furnaces for melting cathodes are being built. The Baltimore refinery has a furnace 14 ft. 6 in. by 48 ft. and the Chrome plant has just finished one 13 ft. 11 in. by 40 ft. The narrower furnace makes it easier to control the roof repairs, which are always higher than in reverberatory smelting, owing to the cyclical instead of continuous operation, with consequent temperature changes. Longer furnaces were tried by the Michigan Smelting Co. a number of years ago, but as these were shortened after a trial, development in this direction was given a check. It appears that troubles from other sources were unjustly blamed on the length of the furnace. The new Chrome furnace has a sand bottom,

[16]"Bull. of A. I. M. E.," August, 1914, p. 2029.
[17]"Bull. of A. I. M. E.," November, 1914, p. 2738.
[18]"Bull. M. and M. Soc. of Am.," Vol. 7, No. 9.

chrome-brick side walls and a silica-brick roof. The indicated coal consumption appears to be about 10%.

Some excellent results have been obtained from recent waste-heat boiler installations at the Chrome refinery. B. & W. type boilers, followed by economizers, have given equivalent evaporations ranging from six to seven pounds, and it is believed that with some changes a clean boiler will give eight pounds. Cold water is fed to the economizer and part of the feed leaving the economizer is returned to the entering side by means of a small centrifugal booster. This prevents sweating and corrosion.

The problem is more difficult than in smelting practice, as there is a great range of capacity to take care of, again due to the cyclical operation of the furnace, although modern methods of recharging are steadily minimizing the difference. There is an additional handicap in that while a high-grade bituminous coal is burned at the refining furnace, a much cheaper steam size of anthracite is burned under the boilers at the Atlantic seaboard refineries and this lowers the cost of the steam with which the waste-heat steam must compete, and hence the value of the waste-heat steam.

Metallurgy of Zinc in 1914

By W. R. Ingalls

The art of zinc smelting is one involving a multiplicity of details, careful attention to which is necessary in order to secure good metallurgical results. Progress in this branch of metallurgy therefore rarely occurs through the introduction of any radical innovation, but rather through improvements in minor details.

Thus American smelters have been devoting a good deal of time and expense to the manufacture of a retort of more tensile strength and more durability than has heretofore been made in this country. As a rule, the "hard driving," i.e., distillation at very high temperature, as practiced in Germany and Belgium, is unknown in America. Distillation under that condition means higher extraction of zinc, other things remaining equal, one of the things that must remain equal being satisfactory retort life. Certain American smelters have been directing their attention to making retorts conforming essentially to those used in Germany. They have been handicapped somewhat by the American clays, which do not conform to the European, but the difference has been rectified artificially. The retorts made in this way by one important smelter show a much longer life, the retorts lasting until the shell, in numerous cases, is not over 3/8 in. thick.

Considerable attention is also being given to the analysis of the reduction fuel, and the relation of the elements of its ash ingredients to the same elements in the ore, having in view a better blending of ore and reduction material. This, of course, is excellent sense.

It is attention to just such details as the above that makes or breaks the zinc smelter. At Hillsboro, where such thought and care have been exhibited, the extraction of zinc averaged about 2% higher in 1914 than in 1913.

Furnace Firing

Experimental novelties in the firing of both roasting furnaces and distillation furnaces are the use of crude petroleum and coal dust. Crude-petroleum firing has indeed ceased to be a novelty. Coal-dust firing was tried at Collinsville, Ill., in connection with the roasting furnaces (Brown horseshoe) and the distillation furnaces, but the experiments were not developed to a conclusion. Nor were they at Cherryvale, Kan., where one of the distillation furnaces was fitted up for this purpose. The indications were regarded favorably at Cherryvale, the ability to produce the requisite temperature and the cheapness of this method of firing being regarded as settled, but the mechanical details remain to be worked out satisfactorily.

At Cherryvale several of the furnaces are regularly operated with oil-firing and with oil- and natural-gas firing combined. The oil burners take low-pressure air, low-pressure oil and high-pressure steam. These burners, five in number, are introduced from the cellar into the rear of the combustion chamber.

In connection with the roasting furnaces the oil burners are also successful. They are introduced through the roof arch, being placed like the five of a pack of playing cards. The first two, set abreast, are each about 2 ft. from the side wall of the furnace. The next burner is 9 ft. back of the line of the first two. The two remaining burners are 9 ft. back of the middle one.

It is found at Cherryvale that in roasting about 125 gal. of oil per ton of crude ore is required, and in distillation about 250 gal. per ton of roasted ore. With oil costing 50c. per bbl., the use corresponding to those figures is reckoned as being equivalent to the use of gas at about 6c. per 1000 cu.ft.

Treatment of Residuum

The method in use at Cherryvale, which has been mentioned in previous reviews, continues to give satisfactory results. All of the residuum is sifted over a screen with 5/8-in. apertures and over a 20-mesh screen. The oversize from the 5/8-in. screen goes back to the distillation furnaces, being high in zinc. The material between 5/8-in. size and 20-mesh goes to the steam boilers, where it is burned on perforated grates, undergrate blast being supplied by Connersville blowers. Some zinc oxide is recovered from the rear of the combustion chamber and is saved.

At the Bartlesville works of the Bartlesville Zinc Co., Archibald Jones is clinkering the residuum by burning it in heaps, the prime purpose being to put it in good condition for the lead smelter, but incidentally some of the zinc is reduced, volatilized and collected as oxide in the outer part of the heap. Such portions are saved separately for reworking for zinc. The amount gained in that way is perhaps not yet very large, but Mr. Jones has by no means given up hopes of increasing it.

Charging and Discharging Machines

The use of the Saeger charging machine is now a matter of regular practice at the works of the National Zinc

Co., at Bartlesville, Okla. It is found that the quality of the work done by this machine is better than it is possible to do by hand, i.e., the retort is much more satisfactorily charged. The operation of hand charging requires three hours. The machine does it in one hour and enables 2000 lb. more of ore to be put in the furnace. In other words, the retorts are charged more densely.

It is found that the excessively fine flotation concentrates now coming to the zinc smelters are producing two difficulties in machine charging. One of these is the sticking of the very fine ore to the augers, necessitating frequent cleaning of them during the charging operation. The other is the tendency of the retorts to blow out with considerable force, sometimes only 20 minutes after they are charged, thereby burning the men putting up the condensers. This, of course, is due to the difficulty of the gas to find egress through the minute interstices of this excessively fine charge; and increasing the density of the charge naturally increases this difficulty. Gas is developed in the charge, and, being unable to issue freely, acquires an increasing pressure from the heating until the pressure becomes sufficient to blow out more or less of the charge. Even before the days of the charging machine and the fine flotation concentrates, cases have been known of a retort actually exploding when it had been charged very densely and had not been spiessed sufficiently often.

J. J. Simmonds, of Iola, Kan., patented a retort-discharging machine. This consists substantially of a truck carrying a series of bars, or plungers, with sprockets at each end of the bar over which travels an endless chain of scrapers. The machine is run up facing a tier of retorts, into which the scrapers are introduced and set in motion, the mechanical arrangement being very ingenious. After one tier of retorts has been cleaned, the scrapers are withdrawn, the machine is moved ahead, and another tier is treated in the same way, the discharging of the retorts being thus done tier by tier. This apparatus was developed at the works of the Laharpe Smelting Co. After that plant became idle the machine was put in operation at the No. 3 plant of the Prime Western Spelter Co., at Iola, and was operated there for three months for demonstrating purposes. Mr. Simmonds, the inventor, has informed me that the average time required to discharge a tier, or vertical row of retorts, is about 45 sec., when the machine is once in position at the furnace and in motion, divided as follows: 5 sec. to move the scrapers to the mouth of the retort, 25 sec. to discharge the retort, 10 sec. to withdraw the scrapers, and 5 sec. to move the machine forward to the next position, i.e., to attack the next tier of retorts. The scraper chains are sprayed with water, which keeps them cool. The apparatus is not only speedy, but also is reported to do good work and to be capable of handling a residue that is considerably fused. In the opinion of some distinguished zinc metallurgists this machine has solved the problem of mechanically discharging retort-residues. Arrangements are now being made to install the machine at three works.

Roasting Furnaces

The new Sand Springs plant in Oklahoma was equipped with Cappeau furnaces, but most of the new zinc smelteries of the United States are built in the Eastern coal fields, are designed to make sulphuric acid and their builders stick to the mammoth Hegeler furnace, a construction capable of roasting about 50 tons of ore per day and costing about $75,000. The improvements in this furnace, since its introduction about 30 years ago, have been only in structural features and mechanical details.

The Spirlet, one of the popular new European furnaces, was introduced in the United States in 1914 by the Grasselli Chemical Co. This is a multiple-hearth turret-furnace, whereof the hearths themselves are revolved, projecting teeth from the bottom of one hearth rabbling the ore on the next hearth below. The furnace is ingeniously designed so that it may quickly be dismantled for repairs and it desulphurizes blende with very low fuel consumption, 10% or less.

Hydrometallurgical Process

At any given time during the last 20 years it has been safe to assume that experiments with hydrometallurgical processes of zinc extraction are going on at three or four places, and 1914 was no exception. The work at Bully Hill, Calif., was checked, but only temporarily, the metallurgists of that company apparently thinking well of the results so far. Some plans regarded as promising are also being carried out by the Consolidated Mining & Smelting Co. at Trail, B. C. Both at Bully Hill and at Trail the idea is to sulphatize the zinc and electrolyze the solution. The Bunker Hill & Sullivan took over the Malm process, has tested it in a 50-ton plant at Kellogg, Idaho, and Mr. Bradley has pronounced it a success. In this process the zinc and lead of the ore are chlorinated, giving a chloride solution from which metallic lead is precipitated by means of metallic zinc. The zinc-chloride solution is then boiled down and molten zinc chloride is electrolyzed, giving chlorine and zinc, which go back to the process, except that the surplus zinc is ready for market as spelter. Some details of the process remain to be worked out, among others the handling of the chlorine gas, which always has been a troublesome feature in the processes of this class. In California some experimental work was done with the Reed process, making electrolytic zinc out of the bag-house fume from the Mammoth Copper Co.

Electric Smelting

No additional news of technical nature has come from Trollhattan and Sarpsborg. A lawsuit over patents between the Trollhattan and the Ilen companies was decided in Norway in favor of the latter. Thierry is reported to be smelting in the Pyrenees zinc residues from the indigo-dyeing industry and to be making a commercial success of it. Krefting did experimental work in Norway, Cote & Pierron at Ugine, in Savoy, and Queneau in Belgium. The experimental work at Nelson, B. C., was discontinued, it being regarded as conclusively settled that an electric zinc-smelting furnace so small as one ton of daily capacity is a commercial impossibility, while the satisfactory development of a larger furnace was regarded as too doubtful to be undertaken at Nelson. Johnson did a lot of interesting work at Hartford, Conn., and organized a company that is going to build a commercial plant at Keokuk, Iowa, his plans including a furnace larger than anybody else has yet built and operated.

Stamp Milling in 1914

By Herbert A. Megraw

Stamp milling during the year has followed closely the practice of the past few years, and there have been no new developments of especial interest. Possibly the most interesting installation completed during the year has been that of the Aurora Consolidated, at Aurora, Nev., where forty 1600-lb. stamps were installed. The Aurora people believed these to be the heaviest stamps operating in the United States, but this is not true, since the Iola Mining Co., at Candor, N. C., installed 1700-lb. stamps and has been running them for some time. Incidentally it may be mentioned that the Iola company has worked out its deposits and sold its mill, which it is believed will now be run on a mixture of ores from the surrounding district.

The stamps at the Aurora mill crush through ¼-in. screen, and the product is tube-milled. Each battery of five stamps is driven by an individual back-geared motor powerful enough to lift the stamps into action from whatever position they may be, so that it is not essential that they be hung up before starting. The tube mills at the Aurora are 6 ft. in diameter by 16 ft. long, and are in closed circuit with Dorr classifiers, the latter being said to be the largest so far constructed. The tubes are arranged in units of two, each pair being driven by a 150-hp. motor equipped with outboard bearings and Morse silent-chain drive. The Aurora mill treats the ore as a total slime.

Another new mill erected during the year is that of the Plymouth Consolidated Gold Mines, Ltd., Amador County, Calif., which was started on the first of August. It is equipped with 30 stamps of 1250 lb. each, running at 104 drops of 7 in. Their capacity, when crushing through 4-mesh screens, varies from 11 to 14 tons per stamp, according to the character of the ore. Each stamp requires 2.34 hp., including the transmission and motor losses.

The mortars are anchored to the foundation by crossbolts. Amalgamation at the Plymouth mill was attempted at first only on plates outside the mortars, but it was found that much of the coarse gold would not amalgamate on the plate, but required grinding or rubbing in contact with quicksilver to insure amalgamation. The difficulty was cured by feeding quicksilver into the Hardinge mills, which follow the stamps in grinding the ore. The ore is crushed to 95% through 60 mesh. When feeding the quicksilver into the Hardinge mill it was found that it amalgamated satisfactorily with the remainder of the coarse gold, and the amalgam filled the interstices between the pebbles of the lining. This inside amalgamation was not continued, however, since it was found that the mercury losses were excessive.

The Uwarra mill, at Candor, N. C., was built without stamps. The ore is first crushed to deliver a 1¾ product, and then taken to two sets of 24x10-in. Allis-Chalmers style B rolls. The shells are of low-carbon steel, and the rolls are operated as wet-crushing machines, five tons of solution to one ton of ore going through them. The product from the rolls is classified and then reground in a tube mill. The plant is operated as a total-sliming mill, the slimes being cyanided. The fact that this mill is built without stamps and has been performing its work successfully is an important step toward the elimination of stamps as primary crushing machines. Upon ores of a character suitable to such work it is cheaper, both in installation and operation, to use rolls rather than stamps.

The most extensive plant planned and about completed during 1914 is that of the Alaska Gastineau at Juneau, Alaska. This is a 6000-ton unit, which will be duplicated when the mines are in position to furnish the requisite quantity of ore. Milling practice will follow rather closely that adopted by the large porphyry coppers. Jaw and gyratory crushers will do the preliminary breaking of the ore, which will then be handled by rolls in series, being classified between each, and finally to tube mills. All the ore will be concentrated, but no information has been made public as to whether the tailings will be rich enough to receive further treatment or whether the concentrates will be shipped or treated on the ground. Conditions in general point to their being shipped to smelters.

The Commonwealth mill at Pearce, Ariz., has been operating most of the year. This plant, as was noted last year, was built with 1500-lb. stamps and the open type of mortar, similar to that in use at Cinco Minas.

On the Rand there has been very little new work in progress. The weight of stamps seems to have reached a maximum beyond which nobody has cared to progress. There seems to be some little tendency to retire somewhat from the high point of over 2000 lb. per stamp which was advocated some time ago. The war has put a stop to all new work in the South African country, and operators consider themselves lucky to be able to keep going.

The Buckhorn mill at Buckhorn, Nev., has been operating successfully during the year. This mill was installed without any stamps, and uses crushers, rolls, Hardinge mill, Akins classifiers, and two tube mills for regrinding. A total slime product is made, agitated in Dorr agitators, and washed by continuous counter-current decantation in Dorr thickeners. The success of this mill, running without stamps, parallels that of the Uwarra, already mentioned, in North Carolina.

The Dome mill at Porcupine, Ont., has doubled its stamp installation, installing stamps of the same weight as those originally used. The tube-mill installation was not increased, but the ore goes through the tube mills once only, and there is no return ore of oversize to them. The result is that about half the ore is treated in the form of slimes and half in the form of sands. The sands are leached in a new addition to the plant which has been installed during the year. Crushing is still in water, as formerly, and the pulp is amalgamated before going to cyanide treatment.

A high-grade mill at the Buffalo plant, at Cobalt, was installed without stamps, only a tube mill being used to grind up and slime the ore which has already been broken to proper size.

The Globe Consolidated, at Detrick, Calif., was installed with twenty 1000-lb. stamps. Crushing is in cyanide solution through 16-mesh screens. The pulp is classified, and reground in a 5x22-ft. tube mill, the slimes going to Dorr thickeners. A total slime is produced by having the classifier and tube mill in closed circuits. The Porcupine Crown at Porcupine, Ont., is operating with

twenty 1050-lb. stamps, making a total of slimes through regrinding in tube mills. Amalgamation before cyanide treatment is practiced also, but in cyanide solution. The new Vipond mill, which has just completed a cyanide-treatment annex, treats the ore in crushers, rolls and Hardinge mills. The whole pulp, now made into a total slime, is treated by cyanide. There is no amalgamation of any sort here. The Cornucopia mill, in Oregon, has twenty 950-lb. stamps, and treats 100 tons per day, cyaniding a total slime.

Analysis of Cyanide Practice

By Herbert A. Megraw

The year has brought forth the usual quota of development in cyaniding and some unexpected modifications. In general, progress has been along the lines of gradual development and not in strides of sensational interest.

The Condition in Mexico

One is compelled to regret, both from a technical and from a business standpoint, the continuance of difficulties in Mexico which have made it almost impossible in many cases, and quite so in many others, to operate mills with any degree of success. Naturally, the construction of new plants has been reduced to a minimum. Technical changes have been almost nil, and those plants which have been able to continue operations have done so with an apprehensive eye upon political conditions, investing no unnecessary money and devoting little thought to technical progression. They have been more interested in producing what precious metal they could and getting it out of the country without having it fall into the hands of political bands who might annex it to further their cause.

The large mills in Mexico have continued to run; those at El Oro, Pachuca, Guanajuato, and other important camps have been operating most of the time, with perhaps one or two periods of idleness about the time of the American occupation of Vera Cruz. Practically all of them have started up again recently, and there is every reason to believe that it will not be long before serious work will be undertaken in all parts of the Republic. Political tranquillity is not to be realized yet, but the trend of events is expected to be in that direction.

The Nipissing Process

The metallurgists of the Nipissing Mining Co., of Cobalt, Ontario, gave publicity to their new process of desulphurizing the rebellious silver minerals which they are treating in their low-grade mill. This is the only item of startling interest in the cyanide mills during the year. The successful attempt to treat high-grade rebellious silver minerals directly by cyanide, without concentration, amalgamation, roasting or any other auxiliary process, has given a distinct fillip to operators who have been accustomed to regard this sort of material as hopeless for cyanide plants and causes them to look about and wonder what mineral will be the next to come under the influence of cyanidation.

Changes in the Porcupine District

In the Porcupine district the feature of greatest interest has been the change in the flow sheet of the Dome mill. The original system of making a total-slime product and treating it by agitation has been supplanted by a separate-treatment process, both sands and slimes being treated each in a special installation. The sands are leached in a new addition to the plant which contains a series of large steel tanks, while the natural slimes produced are treated in the original slimes-treatment apparatus. The mill capacity has been considerably increased, but no additional regrinding mills have been put in, the result being that the amount of natural slimes produced just about equals the total of slimes produced in the original mill. Crushing is still performed in water and amalgamation is practiced as formerly.

Two new mills are working in the Porcupine district—the Porcupine Crown and the Vipond. The latter was formerly operated as a crushing and amalgamating mill, but has recently acquired a cyanide plant which treats the tailings from the mill. The important feature of both these plants is that they have been designed to make use of the continuous counter-current decantation process. The process is carried out in about the same way at the two mills, and since the system at the Porcupine Crown has been adequately described in the Journal, no good purpose would be served by repeating it here.

The development of counter-current decantation has been one of the most interesting features brought forth during the year. The system seems to have been remarkably successful wherever tried, and some mills already built with extensive filters have found it advisable to set aside these installations and make use of the counter-current decantation principle. This has been done at the Tom Reed mine, at Oatman, Ariz., and also at the Gold Road mill, at Kingman, Ariz. Many other mills have made use of the system partly or wholly, and among these may be mentioned the Vulture, at Wickenburg, Ariz., the New Reliance and the Mogul, in the Black Hills of South Dakota; the Nevada Hills, at Fairview, Nev.; the Argo, in Colorado; the Hollinger, in the Porcupine district; the McIntyre, in the same district, and a good many others. The principle is being seriously considered in connection with the hydrometallurgy of copper slimes.

Filter Processes Now Limited

The process of filtering slimes has been changed radically from its original application. It was designed at first to be the sole factor in the recovery of solution and dissolved metal in slimes tailings, but at the present time hardly any filter plant is used for that purpose. Most slimes are being washed, sometimes thoroughly and sometimes only partially, before delivery to the filter, and the latter is expected only to reduce the moisture content. This change is largely due to the continuous-decantation systems which have proved so successful.

Development of Tube Milling

The development of tube milling is a continuation of the tendency noticed during the past two years leading toward shorter tubes of larger diameter. The basic reason for the tendency toward this practice is that it is con-

sidered more advisable to grind in short steps, classifying between each, so that no machine will be clogged up with finer material than it is capable of handling efficiently. It is generally believed that power is saved by this procedure and that a more satisfactory product is obtained.

Classifiers are usually placed directly alongside the tube mills which they serve, the latter being fitted with scoop feeders of large diameter so that the classifier oversize may fall directly into them, while the classifier receives the outflow of the tube mill directly without elevating. According to this system no elevating machinery is necessary, the classifier serving to raise the oversize, which must be ground, to a level sufficiently high so that it can be taken care of by the scoop feeder on the tube mill.

One of the latest installations of the short, large-diameter mills is found in the plant of the Aurora Consolidated Mines Co., at Aurora, Nev., where six mills 6 ft. in diameter by 16 ft. long are performing the regrinding work. The mill is designed to treat 500 tons daily.

A Late Theory of Tube-Mill Grinding

It is worthy of notice that there are some operators who are now advocating a theory at variance with that accepted a few years ago to account for the grinding action in tube mills. It has heretofore been believed that the tubes require such a speed that the pebbles may be elevated so as to fall free through space upon the charge and pebbles beneath them. It is now being said that the grinding accomplished by tube milling is almost entirely by attrition and that a cascading action, the pebbles falling through space, not only does not produce greatest efficiency, but actually detracts from the amount of work done. The question is by no means settled yet, and a good deal of discussion may be expected upon the subject.

The question of tube-mill linings has received no extended discussion recently. Operators have apparently convinced themselves of the advantages of some particular type for their own use, and are sticking to it without further comment. There should be a superlative type, however, and it is likely that further discussion and experiment will discover it.

Agitation Methods and Devices

Agitation methods have followed previous practice, and perhaps there have been some minor betterments of existing machines, but nothing new has been offered. A good many Dorr agitators have been installed in new plants, and a few of the Pachuca type have been built, but not many. One plant, the Uwarra, in North Carolina, installed Hendryx agitators, depending upon violent action to secure prompt extraction results in spite of the higher costs in power for operating. The new Aurora mill uses Dorr agitators, together with Trent replacing machines for changing solutions. It does not include counter-current decantation.

Some mills have been depending upon passage through counter-current decanting machines to secure agitation, but this has been principally limited to gold mills where little agitation is required. The Hollinger has heretofore depended upon that system, but has about come to the conclusion that some additional agitation will be beneficial.

At the Porcupine Crown, two Dorr agitation tanks are used between the primary thickening tanks and the counter-current decantation series. The theoretical use of the continuous counter-current decantation process is not to secure extraction or to displace agitation tanks, but to serve as a washing and replacing plant for cleaning the slimes already treated and making them ready for discharge, free from cyanide solution and dissolved value. When a counter-current system is used, however, it is almost invariably found that some additional dissolution of precious metal takes place and this is usually recovered.

Same Precipitation Methods in Use

Precipitation methods have changed very little from the common use of the past few years. The Merrill zinc-dust process is regarded as the best and most economical in use, and is continuing to enter practically all of the new mills. Its many advantages make it impossible to disregard the process when an installation is considered. The Merrill process has been installed at the new Aurora mill in Nevada. Zinc shavings are being used in many of the plants in which they were originally installed and in a few of the small, temporary plants which are being erected at the present time, but in hardly any of the large modern installations. There is no denying the fact that zinc shavings will precipitate about as well as zinc dust, but are more expensive of zinc and labor, and involve a handling of loose precipitate without any safety factor, which is satisfactorily avoided by the use of the Merrill processes, including the locked filter press.

Leaching Sands

The change of the Dome mill from a total-slime plant to a separate-treatment plant opens up again the question of all-slime vs. separate-treatment processes. The truth of the question, of course, lies in the comparative cost of regrinding to make a total slime, and sand treatment, while considering the additional metal left in tailings as part of the cost. If the amount of metal recovered from the sands by leaching allows sufficient profit over its cost more than to counterbalance the higher saving attained in the all-slime process, less its undeniably higher cost, then the sand treatment is better. The question must undoubtedly be worked out for every ore considered. An additional question appears in selecting the proper mesh, or fineness of grinding to which the sand must be reduced for leaching treatment. It has been often pointed out that sands, whatever their fineness, may be leached, so that the fineness required in any particular ore must be worked out with reference to the cost of grinding to that point. We may expect to see other plants turn toward sands leaching if the Dome experiment is successful.

The Flotation Process

In view of the rapidly expanding interest in the flotation process, we endeavored to obtain some data showing the present magnitude of its development in America. That such development has already become large is exhibited by a list of 31 mining companies that are now using it in one form or another.

The responses to our inquiries which were quite harmless, were noteworthy in their exhibition of the bane which the protracted patent litigation has spread over this important subject. We inquired respecting the name of the flotation process employed, the number of flotation units, their aggregate monthly capacity, the tonnage of

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material treated in 1914, and the tonnage of concentrates produced, the quantity of oil used and the kind of ore treated.

Several mining companies excused themselves from answering "by advice of counsel." Certain companies that are operating without license said plainly that they preferred not to communicate any data. Butte & Superior, the largest user, was frank and full. So were, in general, the companies which replied that they are using the Minerals Separation Co.'s process, but one of these replied that under the term of its license it could not furnish information respecting the quantity of oil used.

Eight companies, including all but one of the large producers, reported that they had treated about 700,000 tons of material in 1914, producing about 120,000 tons of concentrates. Six of these companies, which treated about 520,000 tons of material, used about 1,560,000 lb. of oil, or an average of about 3 lb. of oil per 2000 lb. of ore. The largest part of the concentrates produced was blende, going to the zinc smelters, but there was a substantial production of copper-sulphide mineral, going to the copper smelters, and of galena concentrate produced by the mills in southeastern Missouri.

With regard to the process used, the mining companies operating under Minerals Separation licenses generally said they were employing the "Minerals Separation" process. Certain of them specified the modification, e.g., the "Minerals Separation, cold non-acid." Others are using the Callow, Towne and other processes. Others report generically that they are using the "froth-flotation" process.

A good many of the mining companies on the list of 31 report that their work so far has been merely experimental. Most of these companies express themselves hopefully respecting the expected outcome, but one which has tried several types of flotation apparatus reports that results have varied between mediocre and poor, this being in the case of a certain copper ore which, apparently, is not well adapted to flotation

In general, however, the data communicated to us indicates a wide range of ores that are capable of treatment by the flotation process. We think that it is reasonably safe to say that nearly 1,000,000 tons of ore were treated in North America in 1914 by the flotation process, and the production of concentrates was, without any doubt, upward of 150,000 tons. These figures are impressive, but they are below those of Australia where the flotation process received its initial commercial development and from where an immense tonnage of floated blende concentrate has been derived annually in recent times. Without any doubt there is going to be a far larger use of the process in America in the near future; and we feel safe in prophesying that its use for the treatment of low-grade copper ores will greatly exceed its use for zinc ores, and within a very short time will amount to millions of tons annually.

Gold Dredging in 1914

By Robert E. Cranston*

During 1914 the progress of the gold-dredging industry was nearly at a standstill. Few new dredges were built, although several of those that had worked out their ground, or become obsolete, were dismantled and rebuilt, or taken to other fields and there rebuilt. Doubtless owing largely to the fact that there was so little new construction, few marked improvements were made in machinery or methods. Although we hear of so little actual new building going on, still there are many reports out that different properties are about to be equipped for dredging purposes and it is possible that in 1915 we may see some revival of this form of mining. The depressed financial condition caused by the European war may have had quite a little to do with the lack of progress, but the main cause is, I believe, that there is little land left in this country which is suitable for dredging. Those who have dredging properties now operating successfully are fortunate, since there is no better business in strained financial times than gold mining, and gold dredging in particular, on account of its assured results and regular production.

Several new dredges were built in Alaska and the Yukon, but there was not the activity there which seemed assured at this time last year. Siberian fields were as a whole a disappointment, although there may be many areas there that will be found to pay well. The country is so large and parts of it so difficult of access that much time is required to ascertain its value. The results of South American exploration were also decidedly unfavorable and considering the large amount of money that has been expended there for investigation work the results are most discouraging. I have seen several favorable reports from properties in the Philippine Islands, but we must await more matured data before any reliable opinion can be given as to the future of dredging in that country.

*Mining engineer, Holbrook Bldg., San Francisco, Calif.

California

During the early part of 1914 the Northern California Mining Co. applied for the privilege of operating a gold dredge within the town of Oroville. For this privilege it was willing to reclaim a certain amount of land and make it into a park for the town, but, owing to objections by the citizens, this plan was abandoned. The State Anti-Débris Association brought suit against the Pennsylvania Dredging Co. for dumping tailings in the Feather River and there were several other like suits brought in different parts of the state. Where actual damage was done the companies were usually forced to discontinue the work producing this damage, but where no damage could be shown decisions were rendered in favor of the companies. This is as it should be. During October the Indiana Gold Dredging Co. installed a reconstructed dredge near Chico, on Butte Creek; this dredge was rebuilt from their old No. 3, which was originally at Oroville and went into commission in April, 1904. During the year the tailings dump of the old Cherokee mine near Oroville was prospected and it is claimed that the results warrant the installation of a dredge to handle this material. The Bear River was again prospected. The people doing this work were said to be Nevada capitalists. This area has been

gone over many times and the actual dredging results there have not been satisfactory, so I have not much hope that the results of this new prospecting will open up any great quantity of land suitable for dredging in this district. The Gardella Dredging Co. completed a 5-cu.ft. bucket dredge for the Gold Hill mining district in Auburn Ravine; the machinery for this dredge is from a dismantled boat at Oroville. On the American River the El Dorado & Placer Counties Gold Mining & Power Co. built a gold dredge at Butcher Ranch. It expects to work a number of bars along the river above the holdings of the Pacific Gold Dredging Co., which company is operating successfully at Mammoth Bar and nearby portions of the American River. Successful dredging operations were reported by the Alta Bert Co., near Trinity Center on the Trinity River, and there was considerable prospecting going on at other points along this river. The El Oro company moved the machinery of its old No. 1 dredge from Oroville to Greenhorn Creek near Yreka, Siskiyou County, there installed it on a new hull and put in a revolving instead of a shaking screen. This dredge, now known as El Oro No. 3, started digging Aug. 20. In the Igo district above Redding a systematic investigation was carried on during the summer, but the results were not made public. In the Folsom district the only matter of interest which I note is that the Union Dredging Co. got into financial trouble, and its 9-ft. Bucyrus dredge was sold by order of the court at public auction. In Merced County the Yosemite Mining & Dredging Co. is having one of its old dredges rebuilt by the Yuba Construction Co.[1] Considerable prospecting is reported outside of the proved area on the Yuba River. I believe there is a fair chance here of finding additional ground which will pay to dredge. The Yuba Consolidated Gold Fields had two of its old dredges (Nos. 3 and 4) rebuilt by the Yuba Construction Co. These dredges have steel hulls and are operating on the Yuba Consolidated Co.'s property at Hammonton.[2] One of the old Indiana company's boats was rebuilt and moved to Michigan bar on the Cosumnes River. This dredge went into commission about Apr. 1.

Other States

There was considerable interest manifested in several districts in Montana. Perhaps Madison County received the most attention, and the country north of Virginia City was investigated by several of the larger California operators. Apparently, these investigations were not satisfactory, since they were discontinued and I can learn of no purchases having been made. The Big Creek placers near Libby, Lincoln County, Mont., were prospected by drilling during the summer and it was expected that all necessary machinery would be placed on the ground and operations started before the end of the year, but the latest advices I have indicate that there will be no work done until next season. In Deer Lodge County, the Butte-Georgetown Gold Mining Co. has tested placer ground near Georgetown.

The dredge at Empire, Ormsby County, Nev., was reported completed, but I have seen no notice that it has yet started operations. This dredge is to be used on tailings from the old Virginia City mills. The Federal Mines Co.'s dredge at Unionville, Humboldt County, is reported as digging 1500 yd. per day. The dredge has 5½-cu.ft. buckets and gasoline is used for fuel.

During the year all three dredges of the Tonopah Mining Co.'s property at Breckenridge, Colo., were put in shape and are now operating. These dredges are said to be doing well. The Bed Rock Gold Dredging Co. is reported as having under construction a dredge for the Hahn's Peak district, in Routt County, Colo. The property is known as the Hornet placers and is in Way's Gulch. The Tin Cup Dredging Co. replaced its old gold-saving tables with a special patent riffle known as the Richards pulsator riffle, made by the Denver Engineering Co. Accurate records are being kept of the results of this work, but they are not available at this time. If this riffle proves a success it may have a considerable bearing on the future equipment of gold dredges, particularly where fine gold and much black sand is encountered.

Early in the year it was reported that two dredges were to be built in Oregon, one near Gold Hill, Jackson County, and the other in Bear Creek. I have had no information as to whether these dredges were built or not. The Santa Fé Dredging Co. of Golden, Bernadillo County, N. M., built a large steam-driven dredge which is expected to handle 6000 yd. of material per day.

Alaska, the Yukon, and South America

The Houston Dredging Co. purchased a new dredge and hydraulic plant for its property at Mile 26. The American Dredging Co. proposes to operate a combination of tin and gold dredge on the Anacopick River. The Arctic company is planning to install a large dredge on Sunset Creek, in the Port Clarence district, and the Circle City Mining & Dredging Co. recently purchased the Klondike Mining Co.'s dredge No. 2, which sank in October, but this dredge is not likely to be in commission again before next season.[3]

In Colombia, the Pato dredge at Zaragosa continued its checkered career. During January and February high values were encountered but in March the dredge got into a clay bank and lost the pond water, and owing to low water in the river was not able to start operations again until April. The dredge then operated successfully until the middle of September when it turned over and sank. It was floated a week or so later and it was estimated at that time that repairs would be completed in about a month. W. H. Prichard reported that further drilling added another hundred acres to the proven area of the Pato territory and bids were submitted for the construction of a new dredge on its San Francisco property.

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[1]This is a 3¾-cu.ft. bucket electrically operated dredge, having a capacity of 2700 cu.yd. per 24 hr.—EDITOR.

[2]These are electrically operated, 7-cu.ft. bucket dredges handling 4000 cu.yd. per day.—EDITOR.

[3]The Straub Manufacturing Co. built two dredges in 1914. One was for the Flume Dredge Co., operating on Crooked Creek, and one for P. Servatius, operating on Arctic Creek, Alaska. These boats are 28x60 ft. and require 24 in. of water for flotation. They have a 37-ft. ladder with 2½-cu.ft. buckets made of ½-in. pressed steel fitted with manganese-steel lips. These two boats ran for the full season, 120 days, and averaged 1000 yd. per day, digging from 4 to 14 ft. deep to bedrock, which is limestone and very hard. These boats are of the flume type and carry a flume 74 ft. long fitted with railroad-iron riffles, with an undercurrent riffle which sends the fine concentrates and gold back to a special constructed table which saves the very fine gold. These boats are fitted with a Krogh 12-in. centrifugal pump which supplies the flume with water. They are also fitted with a 3-in. cleanup pump connected with a 4-hp. engine. The boat is fitted with a 4-hp. Cushman engine connected with a 3-kw. 110-volt generator for lighting purposes. The main power consists of a 60-hp. Western gas engine. All driving mechanism is driven by friction and operated from the pilot house. This boat requires three men on each shift, which is 12 hr.—EDITOR.

[4]Lobnitz & Co., Ltd., constructed a dredge for the Cie. Francaise du Mataroni, French Guiana, South America, with a bucket capacity of 3½ cu.ft., steam-driven. The same works also built a dredge for the Cie. des Mines de la Faleme, Senegambia, 7-cu.ft. buckets, steam-driven, and also two 15-cu.ft. bucket dredges for tin mining in Siam.—EDITOR.

Economic Geology

By Adolph Knopf*

The subject of most general interest during the year was the origin of the garnet zones and associated ore deposits that occur at the contact of limestone and intrusive granitic rocks. Lindgren[1] gives an admirably lucid summary of the present status of knowledge concerning the contact-metamorphic ore deposits, as viewed by those upholding the doctrine that the deposits represent almost wholly an accession of material brought by magmatic emanations. This hypothesis may be characterized, to use a chemical term, as the "fixation" hypothesis. Leith[2] presents the opposing view that the garnet and other silicates associated with the ore minerals are dominantly derived from the recrystallization of substances originally present in the limestone. Most interesting is his contention that this hypothesis, as contrasted with the fixation hypothesis, represents merely a difference of emphasis—surely a recession from the stand taken several years ago—but it is clear that the opponents of the recrystallization hypothesis will hardly accede to this view.

In the forefront of recent papers on contact-metamorphic deposits is that by J. B. Umpleby[3] on the genesis of the Mackay copper deposits, Idaho. These deposits were believed by Kemp to be a unique type consisting of arborescent, pipelike masses of garnetiferous ore inclosed in granite porphyry, which had been formed while the environing porphyry was still viscous. It is shown, however, that the loci of garnetization and ore deposition were determined by blocks of limestone that had become engulfed in the porphyry at the time of intrusion, and that the mineralization ensued after the porphyry had become solid. Kemp's conclusions concerning the prevalence of the lime-iron garnet, andradite, and the high theoretical importance of this fact are amply confirmed. The geologic conditions at Mackay are peculiarly favorable for a study of the moot question of the function of magmatic or meteoric waters in the genesis of ore deposits; after a careful weighing of both sides of the problem the conclusion is reached that the evidence is wholly in favor of the agency of magmatic emanations.

The problem of the contact-metamorphic deposits and the agency of magmatic waters was attacked from a different angle in two stimulating papers by A. C. Lawson. In the earlier paper[4] he challenges the current interpretation that the great granite intrusion in southwestern Montana, known as the Boulder batholith, is a batholith, and argues that it is in reality an irregular, transgressive laccolith resting upon a synclinal basement. The surrounding bedded rocks thus dip in under the igneous mass. Under this supposition conditions during the cooling of the laccolith would, therefore, have been ideal for the establishment of a circulation of meteoric waters. It is from solutions of this kind, rather than magmatic waters, that the ore deposits of the Butte and Helena mining regions originated. Regarded from another aspect, this paper illustrates forcibly how often the practical problems of mining geology are closely tied to the apparently abstract problems of petrology. In the second paper[5] Lawson, replying to his critics, attempts to show, with considerable success, that much of the argument in favor of magmatic waters applies equally well to the hypothesis of meteoric waters and that the problems of the origin of contact-metamorphic deposits is still an open question. Continuing, he points out that at Bingham, Ely, Bisbee, Clifton-Morenci, and probably at Cananea, the ores are genetically associated with an intrusive mass which in every case invaded a syncline. The structural conditions at these mining districts, therefore, favored the establishment of an energetic circulation of waters of surface derivation; and until this possibility is disproved, the doctrine of magmatic waters cannot be held to be a scientifically established theory.

Gold Deposits

The genesis of the Rand deposits, which now supply 38% of the world's annual output of gold, was discussed at length by C. B. Horwood,[6] who is an ardent advocate of the infiltration theory. These articles contain much material of value, but the treatment is diffuse and unsystematic. The mineralization is regarded as genetically affiliated with the intrusion of the diabase dikes associated with the reefs, but the evidence adduced, as may be said of earlier similar attempts, can hardly be deemed conclusive. In a brief discussion E. T. Mellor[7] announces that his detailed mapping of the Witwatersrand is approaching completion and that he has found much evidence in support of the placer theory, in addition to that already brought forward by the advocates of that view. It is obvious, therefore, that the origin of the Rand gold deposits is not yet a closed question. Of interest in this connection is the fact that in two recent reports[8] buried auriferous placer deposits are carefully described; and the description of these undoubted "fossil" placers demonstrates that some of the arguments that are advanced for and against the placer origin of the Rand gold are without serious merit.

Malcolm Maclaren has contributed a paper on "The Persistence of Ore in Depth,"[9] but despite the comprehensiveness of the title, the discussion is restricted to gold deposits. His main thesis is that geologic structure, by which is meant the chemical and physical character of the wall rocks inclosing gold deposits, is the vital factor in determining the persistence of ore in depth; "depth" exerts only an indirect control, inasmuch as the greater the depth, the greater is the likelihood of change of geologic structure. An interesting application of this principle is to the Mother Lode of California. According to Maclaren the carbon of the Mariposa slates was the factor that determined the precipitation of the gold in the veins of the Mother Lode system; hence those veins that are inclosed in the black slates will hold their gold tenor down to the lower limit of practicable mining, whereas the

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[1]"Econ. Geol.," Vol. 9, p. 283.

[2]Idem., p. 293.

[3]Idem., pp. 307-358.

[4]"Is the Boulder Batholith a Laccolith? A Problem in Ore Genesis," "Univ. Cal. Bull. Dept. Geol.," Vol. 8, No. 1.

[5]Idem., Vol. 8, p. 219.

[6]"Min. and Sci. Press," Vol. 107, p. 563 et seq.

[7]"Min. and Sci. Press," Vol. 108, p. 781.

[8]Diller, J. S., "Mineral Resources of Southwestern Oregon," "U. S. Geol. Surv. Bull. 546;" Moffit, F. H., "Geology of the Nome and Grand Central Quadrangles, Alaska," "U. S. Geol. Surv. Bull. 533."

[9]"Min. and Sci. Press," Vol. 108, p. 566.

veins inclosed in amphibolite schist, as at Angels Camp, will fail in depth. This hypothesis is of great economic importance, if it can be substantiated. So long ago as 1896 Lindgren had shown the inapplicability of this explanation to the veins of the Grass Valley district, and in his recent work on mineral deposits, he emphasizes his earlier conclusion that the influence of carbon as a precipitant of gold from hypogene vein-forming solutions has been much overrated.

T. A. Rickard[10] dissents from Maclaren's hypothesis, and, fortified by the solid facts of experience, shows that all ore deposits, in spite of downward continuity of favorable structure, tend to impoverish in depth. The treatment of the subject is essentially empirical, but W. H. Emmons,[11] singling out one factor that influences the persistence of ore in depth, shows that the mineral composition of primary ore is likely to govern the range of metals and sulphides deposited during secondary enrichment, the downward extent of enrichment can, therefore, be prognosticated with some degree of probability.

Silver-Lead Deposits

The origin of the silver-lead-zinc deposits of the Broken Hill region is the principal subject of a recent memoir.[12] The Broken Hill lode, which is one of the world's greatest argentiferous lead-zinc deposits, has heretofore been but inadequately described and accordingly this contribution to its genesis is to be welcomed, although it falls far short of the detailed completeness commensurate with the economic importance and the geologic interest of the deposit. The country rocks in the vicinity of the lode consist of schists and gneisses, which are shown to be of pre-Cambrian age. These have been cut by large intrusions of granite, following which came innumerable pegmatite dikes, all of pre-Cambrian age. The ore is composed of argentiferous sphalerite and galena with a little pyrrhotite; the gangue materials are chiefly rhodonite and manganiferous garnet, with minor quantities of quartz and fluorspar and sporadic apatite and tourmaline. Toward the extremities of the lode the gangue becomes dominantly composed of calcite. The gangue minerals indicate that the deposit originated at a relatively high temperature; the quartz when tested optically according to the methods advocated by F. E. Wright showed that this temperature, however, did not exceed 575° C. This agrees with all experience so far gathered; no quartz occurring in an ore deposit has yet been found that was formed at a temperature higher than the 575° inversion point. The pegmatites, many of which are metalliferous, are thought to be of unusual interest as illustrative of their rôle as ore bringers. Following upon the intrusion of these pegmatites, and as a later phase of magmatic solidification, solutions were given off from which the constituents of the orebodies were deposited. The Broken Hill lode is, therefore, like its inclosing rocks, of pre-Cambrian age.

Lindgren and Whitehead[13] have described a remarkable deposit of jamesonite (2 Pb S. Sb_2S_3) at Zimapan, Mexico. Its unusual mineral association—garnet, danburite (calcium borosilicate), amphibole, and others indicate, like that at Broken Hill, that a relatively high temperature prevailed at the time it was formed; to determine this temperature more closely a careful study of a sodium-chloride cube occurring in a liquid inclusion in quartz was made, from which it is concluded that the probable temperature was 525° C. This result, however, was obtained by extrapolating the solubility curve of sodium chloride nearly twice its known length, so that some doubt attaches to this determination; such are the difficulties that beset present attempts at geologic thermometry.

Coal and Iron

"The Origin of Coal,"[14] by David White and Reinhardt Thiessen, is a comprehensive report on the genesis of this mineral fuel. The report falls into two portions. In the first half White considers the geologic features of the occurrence and origin of coal. He discusses the physiographic conditions that prevailed during the deposition of the coal-forming substances, the climatic conditions and the rate of deposition. After a brief consideration of the 10 theories that have been advanced to account for the devolatilization of coal, the hypothesis is maintained that the transformation of peat or lignite to coal of higher rank is effected by regional thrust-pressure, essentially horizontal in direction, acting on and transmitted through the buried coal-bearing strata. In the second half the results of an elaborate microscopic study of coals by Thiessen are presented, from which the conclusion is drawn that "coal is chiefly composed of residue, consisting of the most resistant components of plants, of which resins, resin waxes, waxes, or the derivatives of the compounds composing these, are the most important." A notable feature of the report is the large number of photographic illustrations of microscopic sections of coals, resulting from the devisal of a new technique. This publication, without question, contains the best treatment of the origin of coal that has yet appeared under one cover and is not burdened with too extended an array of details or citation of authorities.

A treatise of more general scope is that by O. Stutzer, entitled "Kohle (Allgemeine Kohlen Geologie)." This forms the second volume of "Die Wichtigsten Lagerstätten der Nicht-Erze" by the same author. It is an attractive volume, and parts of it will prove of interest even to those not specialists in coal.

A valuable work on the iron ores has lately appeared from the pen of E. C. Eckel.[15] This volume furnishes in succinct form a conspectus of the world's iron-ore deposits, as viewed in their geologic and economic relations. The outstanding feature of the geologic portion of the volume is the emphasis laid on the predominant importance of the ores of direct sedimentary deposition. The sedimentary ores are estimated by Eckel to comprise so large a proportion as 63.1% of the known iron-ore reserves of the world. There seems to be no question in the author's mind that all of the bedded, or to use a safer term, stratiform deposits included in the above summation, have been conclusively demonstrated to be of direct sedimentary origin. Concerning the igneous ores, however, he is more cautious, believing that these "may or may not really exist." Possibly a clue to the cause of

[10] "Persistence of Ore in Depth," "Bull. I. M. M. 122."

[11] "Compte Rendu, 12th Internatl. Geol. Congress," 1914.

[12] Mawson, Douglas, "Geological Investigations in the Broken Hill Area," "Memoir Royal Soc. South Australia," Vol. 2, Pt. 4, p. 211, 1912. Although this publication bears the date 1912 upon its title page, it appears to have reached this country only this year.

[13] "Econ. Geol.," Vol. 9, p. 435.

[14] "U. S. Bureau of Mines Bull. 38."

[15] "Iron Ores—Their Occurrence, Valuation and Control."

this skepticism may be found in the author's own statement on p. 62 that "it is perhaps a natural tendency of human nature to assume that the only possible mode of origin is that which the author happens to have studied." If the tonnage of all ores that are due to igneous processes —magnetic segregation and contact metamorphism—are added up, including in this summation all that by any probability might be considered due to igneous processes, they are found to contribute but 10.7% of the known reserves. Clearly, then, magmatic waters seem not to have played in the genesis of the iron ores the important part assigned to them in the genesis of the other heavy metals.

In recent years the concepts of colloid-chemistry have been applied to the problems of ore genesis, principally to the mineral transformations in the zone of oxidation, where such compounds as opal, chrysocolla, limonite, and the like are common. Few investigators have applied them to the problems of ore deposition from ascending thermal solutions. In this connection Lindgren, following an earlier suggestion by Becker, appears to have been the pioneer, having in 1896 discussed the possibility of the agency of colloids in the formation of the Grass Valley gold veins. Again, Lindgren and Ransome, in order to account for certain features of the Cripple Creek ores, advanced the hypothesis that some of the constituents of the vein-forming solutions had been present in the colloid condition. But these attempts were mainly of a tentative nature, and their validity is in fact denied by Krusch. In a recent paper Tolman and Clark[16] urge a radical extension of these ideas. They find that carbon dioxide and hydrogen sulphide, constituents that are common in hypogene vein-forming solutions, are strong dispersive agents for the copper sulphides, and suggest that the distribution of ores within the veins may be related to the escape of these agents. They believe that the experimental determination of the relative dispersion of the different sulphides at a series of temperatures and pressures will lead to a new advance in our knowledge of the science of ore deposits.

R. C. Wells[17] presents the results of a laboratory study of the electrochemical features of the metallic sulphides common in ore deposits. This work is based largely on the principle that the potential of a mineral functioning as an electrode depends on the concentration of the metallic ion in contact with it; the results obtained supplement in an important way, therefore, the earlier work of Buehler and Gottschalk, who measured the difference of potential between the different metallic sulphides.

Allen, Crenshaw and Merwin[18] have reinvestigated their former results on the genesis of wurtzite (the hexagonal zinc sulphide) and marcasite (the orthorhombic iron disulphide). It has been demonstrated that, under the conditions of experimentation, the unstable forms are obtained only from acid solutions; that is, marcasite, wurtzite and metacinnabar—the dimorphs of the commoner minerals pyrite, zinc blende, and cinnabar—crystallize from acid solutions only. These three minerals are, therefore, of peculiar genetic significance, and investigators will be stimulated to a sharper lookout for their occurrence in ore deposits. In illustration of this a recent paper by Ransome[19] may be briefly referred to. The Goldfield ores were ascribed by Ransome to deposition in an acid environment, and reëxamination of certain of the ore from that district showed that part of the zinc sulphide present has crystallized as wurtzite: a result in harmony with the experimental deductions and with the explanation originally offered for the deposition of the ores.

[16]The oxidation, solution and precipitation of copper in electrolytic solutions and the dispersion and precipitation of copper sulphides from colloidal suspensions, with a geological discussion, "Econ. Geol.," Vol. 9, p. 559.

[17]"Electric Activity in Ore Deposits," "U. S. Geol. Surv. Bull. 548."

[18]"Effect of Temperature and Acidity in the Formation of Marcasite (FeS_2) and Wurtzite (Zn S); A Contribution to the Genesis of Unstable Forms," "Am. Journ. Sci.," Vol. 38, p. 393.

State Geological and Mining Officials

The following lists of the directors of state geological surveys and of the chiefs of state mine-inspection bureaus, constitute a convenient reference:

STATE MINE INSPECTORS, COMMISSIONERS, ETC.

State	Name and Address
Alabama	C. H. Nesbit, Chief Mine Inspector, Birmingham.
Alaska	Sumner S. Smith, Mine Inspector, Juneau.
Arizona	G. H. Bolin, State Mine Inspector, Phoenix.
Arkansas	John H. Page, Commissioner, Bureau of Mines, Manufacturers and Agriculture, Little Rock; John T. Fuller, State Mineralogist; Tom Shaw, State Mine Inspector, Midland.
California	F. McN. Hamilton, State Mineralogist, San Francisco.
Colorado	T. R. Henahen, Commissioner, Denver.
	James Dalrymple, State Inspector of Coal Mines, Denver.
Idaho	R. N. Bell, State Mine Inspector, Boise.
Indiana	Edgar A. Perkins, Chief Mine Inspector, Indianapolis.
Iowa	E. M. Gray, Pres., State Mining Board, Des Moines.
Kansas	Francis Keegan, State Mine Inspector, Pittsburg.
Kentucky	C. J. Norwood, Chief Inspector of Mines, Lexington.
Maryland	Wm. Walters, State Mine Inspector, Midland.
Minnesota	F. A. Wildes, State Mine Inspector, Hibbing.
Missouri	George Bartholomaeus, Sect., Bureau of Mines and Mines Inspection, Jefferson City.
	George Hill, Chief Mine Inspector, Bevier.
Montana	W. B. Orem, State Mine Inspector.
	John Sanderson, State Coal Mine Inspector, Red Lodge.
Nevada	Ed. Ryan, Carson City.
New Mexico	Rees H. Beddow, State Mine Inspector, Gallup.
New York	W. W. Jones, State Mine Inspector, Albany.
North Dakota	Jas. W. Bliss, State Engineer, Bismarck.
Ohio	J. C. Davies, Chief Inspector of Mines, Columbus.
Oklahoma	Ed. Boyle, Chief Inspector, McAlester.
Oregon	H. M. Parks, Director, Bureau of Mines, Corvallis.
Pennsylvania	James Roderick, Chief, Department of Mines, Harrisburg.
South Dakota	Otto E. Ellerman, State Mine Inspector, Lead.
Tennessee	Geo. E. Sylvester, Chief Mine Inspector, Rockwood.
Texas	I. J. Broman, State Mine Inspector, Round Rock.
Utah	J. E. Pettit, State Mine Inspector, Salt Lake City.
Virginia	Capt. Richard B. Roanoe, Mine Inspector, Richmond.
Washington	Jas. Bagley, State Inspector of Coal Mines, Seattle.
West Virginia	Earl Henry, Chief, Department of Mines, Charleston.

STATE GEOLOGISTS

State	Name and Address
Alabama	Eugene A. Smith, University.
Arkansas	N. F. Drake, Fayetteville.
Connecticut	Wm. N. Rice, Hartford.
Colorado	R. D. George, Director, Boulder.
Florida	E. H. Sellards, Tallahassee.
Georgia	S. W. McCallie, Atlanta.
Illinois	F. W. DeWolf, Director, Urbana.
Indiana	Edward Barrett, Indianapolis.
Iowa	Geo. F. Kay, Des Moines.
Kansas	Erasmus Haworth, Lawrence.
Kentucky	J. B. Hoeing, Frankfort.
Maryland	William Bullock Clark, Baltimore.
Michigan	R. C. Allen, Lansing.
Minnesota	W. H. Emmons, Minneapolis.
Mississippi	E. N. Lowe, Jackson.
Missouri	H. A. Buehler, Rolla.
Nebraska	E. H. Barbour, Lincoln.
New Jersey	H. B. Kümmel, Trenton.
New York	John M. Clarke, Albany.
N. Carolina	Joseph Hyde Pratt, Chapel Hill.
N. Dakota	Herbert A. Hard, Fargo.
Ohio	J. A. Bownocker, Columbus.
Oklahoma	C. W. Shannon, Norman.
Pennsylvania	R. R. Hice, Beaver.
Rhode Island	Chas. W. Brown, Providence.
S. Dakota	E. C. Perisho, Vermillion.
Tennessee	A. H. Purdue, Nashville.
Texas	W. B. Phillips, Director Bureau of Economic Geology, Austin.
Vermont	G. H. Perkins, Burlington.
Virginia	Thos. L. Watson, Charlottesville.
Washington	Henry Landes, Seattle.
West Virginia	I. C. White, Morgantown.
Wisconsin	W. O. Hotchkiss, Madison.
Wyoming	L. W. Trumbull, Cheyenne.

The above lists were compiled in December, 1914, from the latest information available at that time.

From the above it will be seen that of the 48 states of the Union, 34 have organized geological surveys.

[19]Ransome, F. L., "Wurtzite at Goldfield, Nev., "Journ. Wash. Acad. Sci.," Vol. 4, p. 482.

Arizona in 1914

Some important legislation affecting the mines was voted in 1914, among which was the law requiring that 80% of the employees be citizens; this law will doubtless be the subject of an appeal to the courts. The vote in favor of prohibition met the approval of most mine operators.

In the vicinity of Kingman in Mohave County, the Tom Reed mine at Oatman and the Gold Road mine at Goldroad, produced about as usual. The Frisco mine was inactive most of the year, but an important development in the district was at the Arabian mine, about 12 miles from Kingman, where the Mines Co. of America carried on work during the year with favorable results, 15 men being employed. The shaft is down about 200 ft. In the Chloride district, the Tennessee and Golconda mines shipped to Needles and Bartlesville, respectively, but the rest of the district was comparatively inactive.

At Hackberry, the Copper Giant mine was taken over by Sen. W. A. Clark, but was shut down on Oct. 6. At the Walkover mine, a small force was kept at work; the ore developed carried an ounce or more of gold, and the copper content was increasing with depth. The Hackberry mine, a large silver producer in years past, was optioned to Qualey Bros., of New York, and a vertical shaft sunk to strike the vein below the old workings. At Music Mountain, the Nevada-Arizona Mining Co. proceeded with the development of its gold property, the enlarging of its mill and the installation of a seven-mile pipe line. At Crown King in Yavapai County, the Nelson reported finding a body of good milling ore and there were favorable developments in the Montezuma. The encountering of ore by the United Verde Extension company in its property east of the United Verde was the event of the year in the Jerome district and bids fair to lift Jerome out of the list of one-mine camps.

The Vulture Mines Co., about 20 miles southwest of Wickenburg, operated steadily throughout 1914, employing 200 men. The company milled approximately 35,000 tons yielding about $16, representing a recovery of from 88 to 90%, an increase over the extraction of 1913. The Nicol shaft was sunk east of the old workings to the 135-ft. level to supply an air connection and to explore some old ground, and incidentally disclosed some good ore. The mercury and tungsten deposits in Maricopa County attracted attention in 1914 and several companies were formed to exploit them.

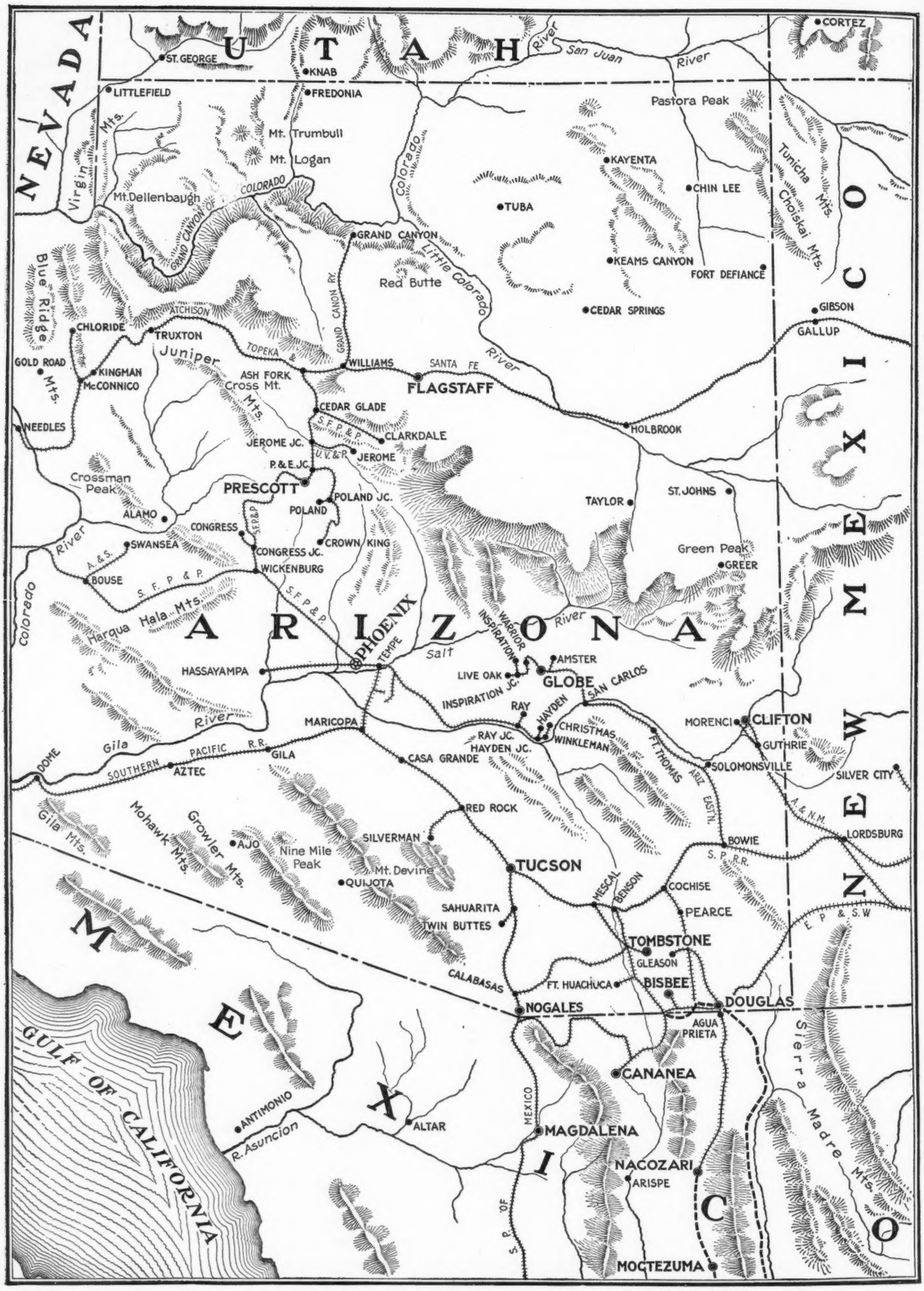
In the Casa Grande district the copper properties did but little, although the Vekol mine shipped a few cars as did also the Lake Shore, which was sold to San Diego men. The Silver Leaf was sold to Mississippi men; the Isabella deepened its shaft and the Reward mine made a few shipments. The O. M. C. Milling Co., a recently organized company, put down a shaft and made preparations to install reduction works to treat the free-milling gold ore on its property 25 miles south of Casa Grande.

The Empire Zinc Co. continued to develop its San Xavier mine in the Twin Buttes district, about 20 miles south of Tucson. The Bush-Baxter mine was started last May from a 10-ft. assessment hole, and at the end of 1914 was producing 500 tons per month from development work by one shift. The ore is purchased by the American Smelting & Refining Co. and up to Dec. 1 over 1800 tons were shipped that averaged approximately 7% copper, 2 oz. silver, 33% iron, 3% lime, 25% silica, and 15% sulphur. Further equipment will be installed. Under the direction of Edmund E. Walter, the old Paymaster mine opened new orebodies; other operators were McGill & White, the Blanche-Rose Mining Co., and H. Whitcomb opened the old property of the Tucson Mines Co. for Chicago men. The Saginaw copper property, owned by Albert Steinfeld, about 12 miles southwest of Tucson, was drilled by the E. J. Longyear Co. for the Calumet & Arizona Mining Co., but without satisfactory results. The Snyder mine in the Sierrieta district, southwest of Twin Buttes, under option several years ago to the Calumet & Arizona Mining Co. with the expectation of developing a disseminated copper-sulphide orebody, was recently leased to the company and 1500 tons of siliceous copper ores shipped to the company's smelting works at Douglas for converter flux. In the Courtland-Gleeson district all company operations were suspended, but leasers worked on the high-grade ore in the mines of the Great Western Copper and the Calumet & Arizona mining companies. The suspension of the Shannon Copper Co.'s operations at Gleeson was due to the decline in the price of copper and will probably be resumed, but the other properties are practically exhausted. The Mascot Copper Co. continued its development at Dos Cabezas.

At Pearce, the Commonwealth Mining & Milling Co. operated steadily with the exception of a short shut-down in August when for two weeks the company was unable to market its bullion; the monthly production amounted to about 60,000 oz., obtained from 9000 to 9500 tons of ore. About 170 men were employed. In the Johnson district, northwest of Cochise, several properties including the Republic copper mine were in operation until the outbreak of the European war.

In Santa Cruz County, the R.R.R. mine, operated by N. L. Amster under lease from R. R. Richardson, was closed down owing to a lawsuit involving the original ownership of the mine. The World's Fair mine was optioned to a syndicate composed of Messrs. Smith, Pearce and others of the Commonwealth mine; development work was started in March and continued throughout 1914, a considerable amount of lead-silver ore having been shipped. The flux mine, near Patagonia, was bonded to a San Diego man and a mill is to be erected as soon as the treatment method can be determined. The Royal Blue, the Bland, and Empress of India mines shipped ore during the early part of 1914, but were closed in August. The ending of the uncertainty regarding the old Baca land grant of 100,000 acres is expected to result in renewed activity eventually. Among developing properties in this county were the O. K., Chief, Connecticut, Buffalo, Three Stars, Red Fox, Joplin, Pittsburgh, Trench, American Boy, Blue Lead, Progressive, Harrison, Old Glory, Warsaw, Havaline, Four Metals and Santo Niño. The Elephant's Head, Duquesne and two properties worked by McIntyre & King near the international boundary, shipped regularly until the war started. The Sheey and the Silver Cañon, worked under lease by the Copper Queen and Thomas Pulliam, respectively, were returned to the owners.

At Castle Dome, the Big Eye Mining Co. ran its 2-



ARIZONA, SHOWING THE CHIEF MINING CAMPS

stamp mill which is being enlarged to five stamps. R. D. Delugge did development work under lease on the King of Arizona mine and expects to install a five-stamp mill. The Castle Dome Gold, Silver and Lead Mining Co. installed a Stebbins dry concentrator, and Phœnix men leased the north end of the Castle Dome Mining and Milling Co. property, C. Platt being in charge. Near Oro Blanco, the Switzerland group of mines was under development and about the end of the year, an important gold vein was cut. W. J. Partridge made several shipments from the Idaho mine. The Austerlitz was idle on account of litigation.

Mining in California in 1914

By Lewis H. Eddy*

There was increase or normal production of metals and minerals in 1914 in California, with the exception of copper and quicksilver.

The North Star, Champion, Empire, Brunswick, Golden Center, Tightner and other deep mines in Nevada and Sierra counties added largely to development and the installation of new modern machinery. In the Mother Lode region development and production were forwarded at practically all the big mines. Installations included a new modern mill at the Plymouth Consolidated, stamps and Hardinge mills combined; and a stamp mill at the Keystone; cyanide plant at the Melones, and electric tram cars at the Eagle Shawmut.

In Shasta County the new electric hoist at the Gladstone mine was completed and set in operation. A cyanide plant was installed at the Midas mine; fire destroyed timbering in the lower levels. The mine was sold to the Victor Gold Mining Co. and reopened.

The apex suit of the Kennedy Extension Gold Mining Co. against the Argonaut Mining Co., which was tried in the latter half of 1913, was decided in favor of the Argonaut in June, 1914. The Argonaut immediately began the removal of the stamp mill and contemplated additional stamps. All the several mines along the Mother Lode, in Amador County, installed satisfactory systems for disposing of the tailings of the stamp mills, chiefly by the adoption of the flume method. A notable deviation from this method and the most important installation for the purpose in the Mother Lode region, or in the state, were the tailing wheels and impounding dam put in operation by the Kennedy Mining & Milling Co. The Zeila mine, at Jackson, Amador County, went out of the producing class practically with the close of 1913. The milling plant and all the surface improvements were removed and the mine permanently closed after an unsuccessful effort to sell the property.

In the first half of 1914 there was an encouraging outlook toward the disposing of mining property to large operators. Some of the important old mines which had been reopened and were in course of development were under consideration by large operators and there is little doubt that important deals would have been made had not the European war tightened the money market. This interruption of mine sales was especially notable in the Forbestown district, where the sale of the Gold Bank-Golden Queen would otherwise most likely have been consummated. This property and the New Burlington were under consideration at the close of the year. An important deal was consummated at the end of the year in Tuolumne County, when the Dutch and Sweeney mines were sold to New York men acting in the company name of Dutch-Sweeney Mining Co., with W. G. Devereaux, manager of the Melones mine, as president.

Electrification of mining plants in Randsburg district marked an advancement particularly notable for the reason that the district is isolated, situated on the northern edge of the Mojave desert. The Skidoo mines and the Cerro Gordo mines advanced in development and production. New development was also undertaken at the Mojave Consolidated, the Tropico on the Mojave desert and at the American Girl and Tumco mines, near Yuma.

The American Trona Co. installed an initial plant at Trona for treatment of the Searles Lake deposit for the recovery of potash, and built a new railroad from Searles to Trona, a distance of 31 miles.

Hydraulic miners adopted improved methods of handling heavy gravel and stacking the tailings away from the streams, demonstrating the economy and practicability of elevating gravel with giants. Improved dam construction has been adopted and in the latter part of the year progress was being made in the construction of a dam provided for impounding of tailings from a large area of hydraulic mines in Sierra and Plumas counties.

The mining and smelting of copper were seriously interrupted the first half of August as a result of the European war. The Mountain Copper Co. discontinued both mining and smelting and suspended work on the construction of a concentration plant, which was to have been completed and in operation before the end of the year. The Balaklala smeltery was not in operation during the year, but the extraction and shipping of ore were in progress until interrupted by the war trouble. The Mammoth Copper Co. reduced its production by closing down one of the three furnaces in operation. Efforts on behalf of the farmers of Shasta County to renew the fight against the Mammoth were undertaken in the latter half of 1914, and a suit was filed in the U. S. District Court in November, the result of which had not been reached at the end of the year. The Selby Commission concluded its investigation and filed a report with the Superior Court of Solano County in favor of the Selby Smelting & Lead Co., finding that the company was not violating the injunction against the court decree after the installation of the baghouse, which was done at the request of the commission.

During the year inspection of mines was in progress by the State Industrial Accident Commission in cooperation with the U. S. Bureau of Mines. This initial work will form a basis upon which may be constructed an adequate mine-inspection law. Organization of the California Metal Producers' Association was completed, and the association has taken up the question of mine insurance, and will also take a hand in future legislation affecting the mining industry.

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Metal Mining in Colorado in 1914

By George E. Collins*

The year 1914 was another comparatively uneventful one throughout this state, no new district having been discovered, and no new mine of exceptional importance. Taking the state as a whole, a large output was made, on a small and insufficient profit margin. Higher metal prices, or metallurgical methods which will permit of the extraction of more valuable aggregate marketable products from complex ores, are urgently needed. To the latter the relatively small extent of most of the orebodies is the most serious obstacle.

As for many years past, Cripple Creek and Leadville continued the most productive districts. In the former the richness with increasing depth of many of the most important mines has been well maintained: this applying especially to the Golden Cycle, Vindicator and Cresson. A bonanza of exceedingly high-grade ore was discovered on the 12th level of the last-mentioned mine in December. Work at the El Paso has been somewhat set back by the burning of the shafthouse in October. The Portland, although not so rich as in its early years, is still an important and profitable mine. Metallurgical methods in this district have finally settled down to a combination of concentration and cyaniding for the lower-grade ores; the higher grades being treated as heretofore by roasting and chlorination. The most important new mill was that erected at the Vindicator mine for the treatment of its low-grade ores by washing and sorting.

At Leadville the output has been well maintained, the drop in metal prices having had a less serious effect than might have been supposed, owing, probably, to the stimulation of leasing activity. It is understood that the principal zinc producers have contracts based on a minimum price for spelter, so that they have been able to maintain production, notwithstanding the low market for zinc. Considerable damage was done by fire to the roasting plant at the Arkansas Valley smelter during October. The principal producers were again the Iron Silver, Wolftone and Yak Tunnel. Arrangements for reworking the down-town properties, to be drained through a central shaft, are being perfected, and it is hoped that work will be commenced early in the coming year.

In the San Juan conditions are still rather dull. At Telluride the Tomboy remains highly productive and profitable, largely through its purchase of the Montana claims. A cyanide plant, designed to treat the tailing from this property, is being hurried to completion. The Liberty Bell continues to be a large factor in the prosperity of the district: but the Smuggler-Union has to face a continually lower grade of ore, and its prospects are not bright. The Black Bear is being reopened and an aërial tramway being built to Pandora, where the ores will be treated by contract in the Smuggler mill. At Silverton the Silver Lake and the Gold King, both worked by tributers, have made a fairly good production; and the Sunnyside, where reconstruction after the fire was completed early in the year, has continued its long career of active output. At Ouray the Camp Bird made a highly satisfactory profit, and the last annual report stated that there was still a year's work assured. The Atlas, where the flotation process is in use, and the Wanakah, which exploits a series of replacement deposits in quartzite, the ore being smelted locally and matte shipped to Omaha for refining, have also produced steadily.

In Gilpin County mining was inactive. In Clear Creek County the output has been greater than for several years, especially in the Argo and Central tunnels. Through the former the Gunnell (a Gilpin County mine) has produced a heavy tonnage of good ore. Some rich ore was found by drifting on the Golden Age, a continuation of the Sun and Moon vein. In the Central tunnel an important and profitable orebody is being opened up in the Lake vein.

In Boulder County the principal new development was in the old Caribou district, where an interesting attempt is being made to treat by cyanidation the low-grade silver ores remaining in the veins and on the dumps. There is little activity in the Creede and Aspen districts, both of which are hard hit by the low prices of lead and silver.

The Colorado mines which have been most unfavorably affected by the war are those treating complex ores, and also those producing ores of the rarer metals, such as tungsten and vanadium. Of the former the most important are the Wellington at Breckenridge; the Iron Mask at Red Cliff; the Mary Murphy at Romley; and the Sunnyside at Silverton. None of these can be making any adequate profit at present prices, and the two last mentioned are largely dependent on their gold values.

None of the smaller districts has been very active. The hopes based on the new silver district at Eagle have not been borne out so far by results, and the same may be said of the newly revived Summitville district. The Rawley at Bonanza is still idle: and the lead mines at Italian Mountain, in Gunnison County, which last winter were producing heavily, are again less active.

The gold dredges at Breckenridge are understood to have had a prosperous season, which has been prolonged until the time at which this article is written, thanks to a mild and late fall. The dredge at Tin Cup has not yielded the results hoped for by its promoters.

Tungsten mining in Boulder County is dull, because of the small demand for tungsten for steel alloys, due to the war. The price ruling ($5.85 per unit for 60% grade) is lower than has prevailed during recent years, and is apparently too low to stimulate activity.

The carnotite industry in southwest Colorado has also been completely disorganized as a result of the war, and shipments have temporarily been almost suspended. Two mills for the dressing of low-grade carnotite ore were nearly completed. In the Daily district above Empire in Clear Creek County, some molybdenite deposits, believed to be of importance, are being actively developed by the Primos Chemical Company.

The strike in the coal districts, where disorder and violence were encouraged by the weakness of the state government, continued throughout the year, and culminated in a sanguinary riot at Ludlow; the conduct of the state

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NOTE—What was apparently an important event in Colorado in 1914 took place just after Mr. Collins' article was forwarded. At a depth of 1269 ft. in the Cresson mine was found a vug or cavity in a watercourse, a common occurrence in this district, but instead of being lined with the usual quartz crystals, this was filled with calaverite. One assay reported to us was 11.341 oz. of gold per ton. The country rock in the neighborhood of the vug will ship $150 per ton.—EDITOR.

militia at which has been the theme of much unjust and ill-informed comment throughout the country. Finally, on the invitation of the governor, Federal troops were brought in, and the result was the immediate subsidence of disorder.

The State Supreme Court reversed a former ruling which seemed to imply that the "gross value" of ore, which the revenue law passed last year used as the principal element in the valuation of mines for taxation, meant the gross assay contents, and defined it to mean the gross sum actually received for the ore at the mine. Another question as to the constitutionality of the law in using both gross and net value as the basis for assessment, is still *sub judice*. It is of no use to increase taxation beyond the point where it fails to produce revenue, and it is quite clear that mines in Colorado, with the exception of the few very profitable ones, are unable to bear further burdens of any kind.

Idaho Mining Industry in 1914

By Robert N. Bell*

In Bonner County, up near the British line, the Idaho-Continental mine completed a concentrating mill of 200 tons daily capacity with a hydro-electric power plant during the summer, but beyond turning it over no production was made. This enterprise has developed 100,000 tons of high-grade lead-sulphide ore, carrying excellent values in silver. In the same county, milling equipment of 50 tons daily capacity was completed on the Lawrence mine, at Clarks Fork, and the Idaho-Montana Amalgamated mine near Bonners Ferry.

In Custer County the Red Bird Mining & Smelting Co. operated its small smeltery for about a month and produced 2700 bars of bullion containing about 80 oz. of silver per ton. The Red Bird mine has been further developed during the year and now shows a supply of relatively high-grade lead-silver ore aggregating about 100,000 tons, with an average value of about 20 oz. silver and 20% lead.

In the same region there are a number of promising lead-silver and siliceous ore deposits that will doubtless be heard from when better transportation facilities are afforded. In the same county, at Mackay, the Empire Copper Co. made its normal production until the war intervened. The usual strong force of lessors has been maintained. A lower tunnel, to be 4000 ft. long, is being pushed, which will undercut its present workings 1000 ft. deeper, and this should reach the ore within a few months. The company is contemplating the erection of a Christensen process mill to handle its extensive reserves of low-grade ore.

The Wilbert mine and mill, in Fremont County, were operated during part of the year and made a production of over 3,000,000 lb. of lead, but was forced to suspend milling by reason of the low prices and the fact that while the resources are relatively high in lead, they have always been low in silver.

In the principal lead-silver mines of the Gilmore district of Lemhi County, the year's shipments of mineral are considerably lower than those of 1913. A good output was made from the Latest Out mine, under the management of the principal owner, Ralph Nichols, and the property is looking its best at the bottom, a depth of 600 ft. A small development force was carried on the adjoining Pittsburgh-Idaho mine.

The adjoining Allie and Gilmore companies have developed several parallel lead-silver veins through a 3000-ft. working tunnel during the year, and are meeting with encouraging results. One of these veins, parallel to the lead deposits, carries a long shoot of earthy-brown iron ore, containing average values of $15 per ton in gold, with only traces of lead and silver, and considerable of it was shipped during the year. A short slab of rich visible-gold ore was found in the vein at the 400-ft. level, from which two small carloads were shipped, containing gold that netted the company about $300 per ton. The two dredging enterprises of this county at Kirtley Creek and Bohanan Creek were successfully operated, and at Idaho City, in Boise County, the dredge of the Boston & Idaho company maintained continuous operation.

The total output of gold from Idaho will be smaller by reason of the almost total suspension of milling operations in the Delamar lode mine, in Owyhee County, which has for years been a large producer.

New interest is being manifested in the placer resources of Idaho at several points, notably in the Boise Basin, where extensive dredging areas still remain; discoveries of dredging ground have been made at the head of the South Fork of the Payette River, in the Warrens, and in the resort district, and it is likely that additional hydraulic and dredging enterprises will be operated and undertaken during the coming year. The Warrens deposit carries a uniform proportion of fairly clean monazite sand in about the same proportion as the black magnetic-iron sand usually occurring in ordinary placer-gold deposits.

In Bonner County, on Boulder Creek, the Idaho Gold & Radium Co.'s property has been under process of development for the past three years. This enterprise is based on an old river-channel deposit of placer gravel more than 100 ft. deep and of extensive area that has been well tested and is said to contain an average value of 50c. per cu.yd. in coarse placer gold. Another deposit of a similar nature and yardage value is being equipped on the Moyea River in the same county.

Some extensive investigation was carried on among the low-grade lode deposits of the Big Creek district in Idaho County, but a wide divergency of opinion as to terms continues to block progress in this interesting region.

An estimate of the gross metal contents of all mineral shipped from Idaho during 1914 is given herewith. The marked increase in zinc output is largely credited to the Con. Interstate-Callahan mine, near Wallace. Its splendid development and production of high-grade crude ore and concentrates during the past year make this property one of the large zinc producers of the world.

The production is: Gold, 63,795 oz.; silver, 13,566,000 oz.; lead, 343,461,000 lb.; copper, 4,402,000 lb.; zinc, 49,207,000 pounds.

*State mine inspector, Boise, Idaho.

Mining in Montana in 1914

By Theodore Simons*

As in past years, Butte, in 1914, furnished the bulk of Montana's copper, amounting to about 200,000,000 lb., the Anaconda and North Butte being the chief producers. During the latter half of the year the decline in the copper demand, due to the war in Europe, made a curtailment of production imperative. The Anaconda's smelting plant, at Great Falls, and a number of its Butte mines, were forced to shut down. Anaconda and North Butte are at present working their largest mines five days a week, with an output of 50% of normal. Butte-Duluth operated all the year, producing 1,515,000 lb. of copper. The East Butte, Alex Scott, Ballaklava, Bullwhacker, Tuolumne are closed down entirely; other properties are confining their activities to development and repair work.

The Conrey Placer Mining Co., operating four dredges in the Alder Gulch district, Madison County, which handled 6,300,000 cu.yd. of gravel, furnished the bulk of the placer gold in Montana. Silver Bow County followed next, the gold coming chiefly from the copper ores of Butte. Prominent among mines, producing gold from dry or siliceous ores, was the North Moccasin of the Barnes-King Development Co., at Kendall, Fergus County, whose output averaged $40,000 a month. Other more or less steady producers were the Keating Gold Mining Co., of Radersburg, Broadwater County, shipping 50 tons of $20 ore per day; the Southern Cross, Deer Lodge County, treating 500 tons a day of $8 ore by cyaniding, and a number of smaller properties in Madison, Blaine, Cascade, Granite, Fergus, Beaverhead, Lewis and Clark counties.

The bulk of Montana's silver came from the Butte copper and zinc mines.

From 313,874 tons of ore mined and milled, the Butte & Superior Co. produced 98,200 tons of zinc concentrates, assaying 53.27% zinc and 25.5 oz. silver per ton; and 4000 tons of lead-zinc concentrates, assaying 45.64% lead, 13.72% zinc and 42.8 oz. silver.

Senator Clark's Elm-Orlu mine and Timber Butte concentrator started operation in July. The mill, of a capacity of 500 tons per day, uses table concentration, followed by oil flotation. Since starting operations, it has produced about 20,000,000 lb. of zinc and 350,000 oz. of silver.

The Havre Natural Gas Co. sank three wells near Havre, Hill County, which assure sufficient gas flow to supply the city with light and power. In Musselshell County, near Ryegate, a Butte company is drilling for oil and gas in a district known as the most promising in Montana. In the Sweet Grass hills, California interests are drilling for oil under the direction of Ira Segur. Similar operations are carried on in the Big Muddy district in Sheep Creek Basin, 17 miles west of Dillon, Beaverhead County.

One of the richest sapphire-bearing districts in the world, situated in Fergus County, 27 miles southeast of Neihart, was profitably exploited by the "New Mine Sapphire Syndicate" of London, England. The gems are in great demand on account of their singular beauty.

The new slimes plant at the Washoe works of the Anaconda Copper Mining Co. at Anaconda was started in March. Its capacity is 26,000,000 gal. of slime-pulp per day. The plant consists essentially of 160 Dorr thickeners and twenty 20-deck round tables with a concentrating area of 108,000 sq.ft. The concentrates upon being condensed in five thickeners, pass through Oliver filters which make dry cakes ready for the smelter. In the same month, construction of the 2000-ton leaching plant to treat the concentrator tailings was begun. Plant will be ready for operation early this year. Roasting in McDougal furnaces followed by leaching and copper precipitation on iron is the process adopted.

The first coal-dust fired reverberatory at this plant was started in September. During that month it smelted 475 tons daily with a coal consumption of 13.8% against 260 tons and 24.1% coal consumption in the natural-draft coal-fired furnaces. The company is now fitting all reverberatories for coal-dust firing and will erect a furnace 144x25 ft., inside measurement, that will smelt 800 tons daily with a fuel consumption of 13.33% or better. The company's 100-ton sulphuric-acid manufacturing plant will be completed early this spring and will furnish acid for the leaching plant and for the local market.

The Butte-Duluth Co.'s leaching plant at Butte was entirely remodeled during the year and now has a capacity of 1000 tons per day. From the new rock house the ore goes to large Dorr classifiers, used for leaching, which deliver the tailings by a belt conveyor to the dump, while the copper-bearing solutions go to 64 electrolytic cells which extract the bulk of the copper. The last wash water passes to an iron precipitating plant, making cement copper.

The East Helena plant of the American Smelting & Refining Co. ran throughout the year at normal capacity of 15,000 tons per month, 10,000 tons of which was lead ore from the Cœur d' Alene district. Two additional Dwight-Lloyd sintering machines installed during the year increased the roasting capacity by 250 tons per day.

No strikes affecting production were reported from any mines in the state. Butte, however, furnished considerable excitement during the latter half of the year resulting from a growing dissatisfaction in the ranks of the miners with the mismanagement of the local union and the Western Federation. Early in June this culminated in street riots, followed by the dynamiting of the Miners' Union Hall, the formation of an independent union, the deportation of miners, and a number of other lawless acts. The fact that the local authorities were unwilling or unable to suppress these disturbances brought a horde of irresponsible agitators to Butte, who day after day incited their hearers to violence, looting and defiance of the law. To prevent a consummation of these threats, citizens of Butte and Silver Bow County appealed to the governor for protection, who on Sept. 1, declared the county under martial law which prevailed until Nov. 1. During that time the state militia, consisting of 700 men and officers, managed the affairs of the city and county. Saloons were closed, street speaking forbidden, the ringleaders of the riots were arrested, and order was restored throughout the city and county. The chief offenders are now serving time in the penitentiary. Unionism among Butte miners virtually ceased to exist and at present the men are working under practically open-shop regime to the great satisfaction of everyone.

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Mining in Nevada in 1914

The mining industry in Nevada progressed appreciably during 1914, and there were many developments, some discovery and some rather important plant construction.

Goldfield Consolidated continued working along the same lines as in 1913, and under the management of Albert Burch its operations have prospered.

The Atlanta property, at Goldfield, is working through the shaft of the Merger Mines Co. Among the companies which are carrying on developments in the Goldfield district, are the Goldfield Oro, Booth, Sandstorm, Kendall Con, Silver Pick, Great Bend, Blue Bull, New Jersey, Kewanas, Yellow Tiger, and the Diamondville Black Butte. Some of these are also shipping small quantities of ore. During the year the Great Bend, Daisy, Vernal, Spearhead, Combination Fraction, and C.O.D. have been operated by lessees. It has been announced that the Milltown, Commonwealth, and Lone Star properties will be operated during 1915.

The Jumbo Extension operated throughout 1914 without interruption. The year's production amounted to about $25,000 tons. The Florence Goldfield Mining Co. operated during the year, making a total profit of about $85,000.

The property of the Aurora Consolidated Mines Co., Mineral County, belonging to the Goldfield Consolidated interests, completed the new stamp mill at Aurora, which is now operating to capacity, about 500 tons per month.

Operations on the Comstock during 1914 were not so prosperous as could be desired. The principal event was the initiation of pumping operations in the Gold Hill mine by the Sturges interests, which control the Yellow Jacket, Crown Point and Belcher mines. A promising body of ore was opened up on the 1500 and 1600 level in the Belcher mine. This is the first time since 1886 that any work has been done below the 1400-ft. level.

During the first half of the year little work was done owing to the differences in regard to the management of the pumping associations. In July these differences were compromised, but the war stopped all development. Most of the mines depend upon assessments for their running expenses and the closing of the stock exchange made it impossible to collect them.

In October, Mexican was beginning to explore at the 2650-ft. level, when a fire in the old stopes caused a loss of access to that level. The fire has since been extinguished and Mexican has recently found good indications at the 2300 level. C. F. Duval, lessee of the Chollar and Potosi and of the Butters mill, has been operating steadily on low-grade ore in the outcrop and upper levels of these mines.

The chief gold-producing camp of the Rochester district is at Seven Troughs, 30 miles west of Lovelock. The Seven Troughs Coalition is equipped with a 10-stamp amalgamation and concentration mill. The production from this mine in 1914 was over $250,000, but only $30,000 of this was produced prior to June. In the Rochester camp, production by leasers at the Rochester Mines Co. up to the end of November was about $610,000 from 25,950 tons of ore. Most of this came from the south 600 ft. of the Crown Point claim, covered by the Big Four and Codd leases, and above the 400-ft. level in the west vein.

Building of the 100-ton mill for the Rochester Mines Co. was nearly completed. A 2700-ft. pipe line was laid for supplying the mill with water.

The Rochester Weaver Mining Co. produced about $25,000 through the work of leasers. The Nevada Packard company produced $73,000, and is now negotiating for a 20-stamp mill. A two-stamp mill is crushing high-grade ore from gold veins on Lincoln Hill.

The Star Peak mine, about 10 miles from Rochester, was developed with satisfactory results. At Jessup, 30 miles southwest of Lovelock, the Mercer group of claims has been developing. A two-compartment shaft is going down 150 ft. to intersect the two known veins. Ore is high-grade gold-silver quartz formation. A recent carload shipped from surface work gave returns of about $57 per ton.

At Manhattan, the War Eagle mill operated steadily during the year. The Associated mill was overhauled and placed in commission after an expenditure of about $8000. The Manhattan Milling & Ore Co. ran its mill continuously on ores from the Big Pine claim, and averaged close to 100 tons per day. During the last month the White Caps company operated the cyanide portion of its mill and the stamps for one shift each day. The Rogers amalgamating mill has been operating intermittently, but made some output. The installation of a new 200-ton mill on the Big Pine claim will add greatly to the production of the district.

The White Caps property developed about $300,000 worth of ore, at the rate of about $17 per ton. It is refractory and will need an installation of a preliminary process and special means of cyaniding, or handling in some other way.

The chief company in the Round Mountain district is the Round Mountain Mining Co., which operated continuously. The litigation between the Round Mountain Co. and the Round Mountain Sphinx Mining Co. was compromised in August, 1913, former absorbing the Sphinx. Lessees have contributed to some extent to the production of the district. The Buell & Patteson lease on the Mariposa claim of the Round Mountain Mining Co. produced approximately $30,000 from a vein averaging 2 in. in width.

The Mason Valley Mines Co. operated the Thompson smeltery and Mason Valley mine steadily until Oct. 17, when the smelting plant was blown out. The smelting plant treated practically all the ores produced in the district, and considerable from Goldfield, Rochester, Luning, and other Nevada camps, and a large tonnage from California properties. Nevada-Douglas Copper Co., of Ludwig, operated the mines until the blowing out of the Thompson smeltery. Work on the leaching plant has been continued, and good progress made in construction and installation. If this plant is a success, large tonnages of low-grade oxidized ore will be made available.

In the fall of 1913 Miami Copper Co. took an option on the Empire-Nevada property, and prospected by churn drilling. Work was stopped in May, 1914, and apparently no deal was made.

There were no particularly important developments at Nevada Consolidated, but some churn drilling for new ore was carried on at the property and also at Giroux during the year. Flotation experiments are still being carried on

at the concentrators, and at the smeltery there are no changes of importance, other than somewhat reduced operating costs in different departments. A strong effort is being made to hold copper costs, running at half tonnage, at the same point they were before the reduction. Secondary-enrichment engineers who have been sent to the various districts by the producing companies, are now in Ely district making field examinations. Their conclusions should be of great value to the mining fraternity.

The Wonder Mining Co. operated mine and mill continuously through the year. About 50,000 tons of ore were milled, at an average cost of $2.74 per ton, recovery averaging 93.2%. The Atlas Wonder Mining Co. operated for the first half of the year.

The Nevada Hills, at Fairview, continued operations throughout the year, as did also the Buckhorn, both properties controlled by the Goldfield Consolidated interests.

The Cortez Mining and Reduction Co., Eureka County, started milling at 1500 to 1800 tons monthly capacity in December, 1913, and continued during the year. The mill was shut down in August and will probably not resume until spring.

The National district continues to be a one-mine camp. Leasing work was done on nearly all the groups of claims directly bordering on the National Mines Co.'s ground, but no ore was discovered. The National mine found milling-grade ore, and is expected to have a longer life. Five stamps have been added to the five already installed. The Buckskin National property, three miles from Nashville, has been a center of activity, and produced some ore from leases.

The most important development in the Yellow Pine district was the discovery of platinum and allied metals in the western portion of the district. The original discovery was made at the property of the Boss Gold Mining Co., about 10 miles west of Goodsprings, platinum being associated with gold and copper in a quartzose gangue. The Yellow Pine Mining Co. operated its plant at about two-thirds capacity throughout the year, producing 2200 tons of lead concentrates, 11,000 tons of zinc concentrates, and 1000 tons of crude zinc ores. The Potosi mine was sold to the Empire Zinc Co. The Frederickson property was sold to O'Kelly and Munzberg, who developed considerable mixed carbonate ore and will erect a mill in the near future Other properties which shipped zinc-carbonate ores are the Mountain Top, Mobile, Anchor, Monte Cristo, Bullion, and Bill Nye. The St. Anthony Mining Co. made 10 shipments of copper ore.

In the Jarbidge district, the Elko Mining Co. operated continuously, employing about 30 men. Considerable development work was done on the property of the Success Mining Co., to a depth of 427 ft. The Bluster people are putting up a duplicate of the Alpha mill of the Elko Mining Co. Only amalgamation will be attempted, tailings being stored for future possible cyanidation.

The Consolidated Nevada-Utah is operating at a profit for the first time. Having installed suitable equipment it has dewatered its No. 1 shaft to the 1400-ft. level, and zinc ore is now being stoped from the three lower levels. While all of the ore is not of shipping grade, the milling ore is being placed in box-cars conveniently located, and a mill will be erected as soon as the proper method of treatment can be ascertained.

The Prince Consolidated is averaging very close to 10,000 tons of ore monthly for the year, at a reported profit of 50c. per ton. It acquired the Virginia-Louise property, adjoining on the south, and work has been commenced on a new vertical shaft. The Day-Bristol property, after having been in the hands of a receiver for a year, will be sold at auction on Jan. 14, 1915.

New Mexico in 1914

The greatest metal production in this state was as usual from the Chino Copper Co. in the Santa Rita district. This company was producing at the end of the second quarter at the rate of 6,000,000 lb. per month from 6460 tons of ore per day. The copper production in September, however, was reduced to about one-half the normal output.

The next most important copper operation is that of the Burro Mountain Copper Co. at Leopold. Here development was in progress during the year, and flotation experiments were carried out at the experimental mill at Tyrone, with which the mine is connected by a standard-gage road and transportation tunnel. Construction of the central power plant, and mine development continued throughout 1914. Near Lordsburg, the 85 Mining Co. and the Bonnie shipped and some oxidized copper ore was sent to El Paso from the Apache district near Hachita.

In the Mogollon district, more ore was mined in 1914 than in any previous year; about 120,000 tons were treated by the three mills, the Socorro, Ernestine and Deadwood; a few minor shipments of high-grade ore were made direct to smelters from the Pacific and Eberle mines. The Socorro Mining & Milling Co. was especially active in the development of new properties, having purchased 20 of the Johnson claims from the Oaks company and optioned the Pacific and the Deep Down groups. The Ernestine company operated about as usual and completed an elaborate geological survey. The Alberta Development Co. and the Precious Metals Exploration Co. became producers, and the Oaks company added another mine, the Eberle, to the list. The Lincoln and the Mogollon Gold & Copper Co. were active part of the year.

Pinos Altos experienced an active year in 1914, owing to the opening of a pocket of rich gold ore early in the year on the Savanna Copper Co.'s Pacific No. 2 claim, by the lessees, Bell & Wright. This find led to a renewal of interest in the Pinos Altos district, and later the C. & O. Mining & Milling Co. found similar ore in its adjoining claim. On Apr. 1 the entire holdings of the Savanna Copper Co. in the district were leased to I. J. Stauber and Ira L. Wright, who found high-grade ore 60 ft. lower than the Bell & Wright workings. Among the development operations, most of which shipped high-grade ore in 1914, were the B. V. N. Mining Co., the Silver Cell, J. T. Janes leasing on the Hard Scrabble, and George Brown leasing on the Manhattan claim. On the west side of the camp the Cleveland mine was purchased by the Empire Zinc Co.

At Fierro, the Colorado Fuel & Iron Co. reduced normal production to about 600 tons per day of iron ore soon after the Colorado coal-mine strike started, and on Nov. 30 discontinued shipments from the camp entirely.

In the latter part of 1914 the Organ camp became the scene of active prospecting operations. The Memphis Leasing Co. in September started sinking a shaft on the

Memphis mine, and almost immediately found a good body of copper ore. Six cars were shipped, ranging from 10 to 15% in copper and carrying some gold and silver. The Excelsior mine also opened some high-grade copper ore.

The American Meerschaum & Pipe Corporation and the American Turquoise Co. both went into the hands of receivers in 1914. Considerable prospecting for oil and gas was done, but with little result. The Lucky Bill at Bayard was operated and at Steeple Rock, the old Carlisle group was taken under development by George H Utter.

In the Magdalena district, on account of the decline in the price of zinc and lead, there was but one company in continuous operation; this was the Ozark Smelting & Mining Co., operating the Graphic mine and a surface-tension flotation plant, near Magdalena. The mill treated about 40,000 tons of ore. The Empire Zinc Co., after purchasing the property of the Tri-Bullion company at Kelly, pursued development work steadily and remodeled the concentrator which will be ready early in 1915. The Juanita, leased to the MacDonald company, made a considerable output of zinc-carbonate ore.

Mining in South Dakota in 1914

By Jesse Simmons*

The gold production of South Dakota approached $7,500,000 for 1914. Placer mining has long since ceased to be an important factor in the annual output—the state mine inspector calculates the yield during the year ended Oct. 31 at only $1800—and aside from the Homestake belt the important producing section is confined to the Bald Mountain district.

Aside from gold, the Black Hills produces gypsum, mica, minerals valuable for their lithia and phosphoric-acid content, tungsten and some copper and lead. During the year the gypsum products turned out by two mills near Rapid City had a value of $60,000. Of mica there was in excess of $6000 worth shipped, a small figure compared with years when the Westinghouse mines were operating at full capacity. Copper exploitation has been restricted since the commencement of the war. Lead is only secured in the smelting of ores mainly from Galena, Carbonate and Silver City, ores which are worked chiefly for their precious-metal content.

During the year the production of the Homestake was in excess of $6,000,000, recovered in the milling of over 1,500,000 tons. Dividends paid during the year amounted to $2,210,208, and employees shared in a bonus equal to 7% of their earnings for the year. Construction was started on a boiler plant to contain six 600-hp. boilers, steam from which will be utilized to drive a new hoisting engine at the B. & M. shaft and an electric generating plant.

In August, the U. S. Commission on Industrial Relations held a session at Lead, examined a large number of witnesses, and secured a mass of valuable testimony regarding the relations of the Homestake company to its employees. In summing up, Professor Commons, who acted as chairman of the commission, paid a high tribute to the Homestake, characterizing it as one of the most liberally managed concerns which the commission had had occasion to investigate.

On Aug. 31, the opening performance was given in the theater of Recreation Hall and Superintendent Grier made a brief address, in which he dedicated the beautiful structure to the employees of the company and residents of Lawrence County.

During the year three of the officials of the company died. They were J. B. Haggin, president; T. J. Grier, superintendent; and W. S. O'Brien, mine foreman, each of whom had occupied his respective position for many years. Their successors are E. H. Clark, Richard Blackstone and Edgar Huntley, each of whom, also, has been connected with the corporation for over a quarter of a century.

First in production of the Bald Mountain mines is the Golden Reward, which company, with nearly 3000 acres of mineral land and a 250-ton cyanide mill, at Deadwood, produced during the year approximately $370,000. Important experimentation was carried forward at the mill in an endeavor to solve the problem of commercial treatment of low-grade "blue" or unoxidized refractory siliceous ores. From exhaustive tests it appears practically certain that a preliminary roast will make a large proportion of the ores amenable to cyanidation. A tube mill was installed. Other mill installations included a Trent replacer, two agitation tanks and a Dorr classifier. The company purchased from the Homestake Mining Co. the Hidden Fortune 60-stamp mill, which was dismantled and a large part of the usable portions removed to Deadwood.

Mogul reëntered the producing class when its mill near Terry was completed early in the year. The plant embodies many strictly modern features. It is equipped with rolls, Trent Monadnock mills and a tube mill; the entire pulp is slimed and cyanided by the usual counter-current decantation process, utilizing tanks equipped with Dorr thickeners. There are also two Dorr agitators used in the process. Pulp is discharged as tailing from the last, or fifth, thickener, where a water wash is given. At the preceding thickener tank barren solution is added and gradually worked forward. The company has granted leases on a good proportion of its mining territory; is operating the North lode on company account; has leased the Clinton mine, equipped it and granted subleases.

Important improvements were made by the Trojan company on its property at Bald Mountain, during the year just closed. Although the company has been operating for a number of years, and earning satisfactory profits, it has been expending large sums each year in betterments intended to increase efficiency in mining and milling. A sharp lookout is kept on the welfare of the men, and during the past summer work was started on the erection of a group of cottages for the married men and a commodious hotel for the bachelors. Numerous refinements were added at various points, the most noteworthy of which was the practical reconstruction of the ore railroad for half a mile, reducing the grade over which the loaded ore

*Deadwood, S. D.

cars are hauled to the mill. The company operates a 250-ton cyanide mill, and also produces high-grade ores which are smelted at Denver. The production for the year was around $360,000.

As a successful operator on low-grade ore, the Wasp No. 2 continued to merit deserved attention and earned $35,000 in dividends on the milling of rock yielding less than $1.60 per ton. During the year a new 18-ton locomotive and a number of dump cars were added to the mine equipment, and are used in removing the overburden excavated by the steam shovel. A Keystone drill was installed early in the summer and has since been kept constantly employed in prospecting.

Manager Bowman continued successfully to apply the continuous-decantation cyanidation system to the ores of the New Reliance property. This was the first adaptation of this process to Black Hills ores, and attracted much attention. Many details have been worked out in actual practice. No agitation is given, other than that secured in the stamp batteries where the ore is pulverized. The slime from the Dorr classifier is treated in four tanks equipped with Dorr thickeners; at the fourth tank barren solution is added; from this tank the pulp goes to a Portland revolving drum filter, where a water wash is given. Sand is leached in the usual manner.

Mill construction was almost completed at the Rattlesnake Jack property, near Galena. The plant will contain stamps and a Hardinge mill for crushing; Trent cyaniding machinery and Merrill zinc-dust precipitating equipment. Stockholders' differences caused a suspension of work at the Bismarck, adjoining the Wasp No. 2. Development was resumed at the Anaconda, near Roubaix, and the Hidden Treasure, on Deadwood Gulch. New mining machinery was purchased late in the year by the Echo company, and delivered at Maitland. V. R. Hodges and associates during the summer months operated the Deadwood Standard property, near Ragged Top, under lease. The Monarch property, on Two Bit Creek, continued to produce a high-grade smelting product from a small deposit. The Heidelberg yielded a quantity of $15 to $24 ore, shipped to the Golden Reward mill, at Deadwood, and announces that it is proposed to sink to quartzite. Further development of the Iron Hill property, at Carbonate, by the Titanic company, resulted in the identification of a large body of milling ore, and preparations are under way to erect a cyanide mill. J. T. Milliken secured the Oro Hondo property, adjoining the Homestake on the southeast, and sinking is in progress; the shaft, which was 1000 ft. deep, will be sunk to 2500 ft. if necessary to tap the extension of the Homestake orebodies. The Ironsides property, on Squaw Creek, produced some ore.

C. H. Kamman purchased the interests of the Pahasa Mining Co., which was the successor of the Harney Peak Tin Co. This may be considered the final chapter of history of the lattern concern, which commenced operations about 30 years ago, expended, probably injudiciously, immense sums of money and finally went into the hands of a receiver. Mr. Kamman for several years acted as agent for the receiver and later was superintendent of the Pahasa company. The Hill City M. & D. Co. purchased hoisting machinery to be installed on the 100-ft. shaft. The First National company did some development and made some mill runs on ore extracted. The Golden Summit property continued to produce high-grade ore in small quantities. The Limelight company completed its mill and operated it during the summer and fall. McNish & Mills made a test run on tin ore, with satisfactory results, and expect in early spring to commence regular operations. The Dakota Continental Copper Co. sank the shaft 37 ft., cut a station at the 825-ft. level, installed a large triplex electric-driven pump, and crosscut 240 ft., suspending work about Aug. 1.

Oregon Mining in 1914

By W. B. Hartley*

There is every indication that the production of gold, silver and lead in the state this year will greatly exceed that of any one of the preceding four years, being estimated for the 12 months ended Sept. 30 at over $1,500,000 by Director H. M. Parks of the Oregon Bureau of Mines and Geology. Labor Commissioner Hoff states that the mining industry has revived in the state and that in addition to individual owners working their placer mines there was employed during the year ending Sept. 30 a total of 578 men. These men were paid $581,650 in wages. These estimates are taken from the larger mines of the state.

A number of reports of the mining fields have been published by the Oregon Bureau of Mines and Geology during the year and several reports are now in the press pertaining to the mining districts of eastern Oregon. A work of 250 pages on the southern Oregon field by A. N. Winchell was recently published.

Eastern Oregon, as last year, produced the bulk of the gold. The Powder River gold dredge has been kept in steady operation. The Columbia, Ben Harrison, Cornucopia, Highland Rainbow and a number of other mines have been steady producers during the year.

The Old Channel mine of Jackson County has been sold to H. K. Owens, C. L. Creelman and John C. Eaton of Seattle, Wash. The new owners are making extensive improvements. The purchase price of the mine was $65,000. The Rawley copper mine on Drew Creek has also been sold to D. Van Ostrand of Milwaukee, Wis., for a consideration of $35,000.

The most recent and approved mining apparatus has been installed in the Oregon Agricultural College school of mines, at Corvallis and the attendance this fall is considered very satisfactory.

It is reported that vast beds of nitrate salts have been discovered near Vale in Malheur County, said to be 75 ft. deep and to cover six sections of land.

Abert and Summer Lakes of Lake County, whose beds are said by experts to contain millions of dollars worth of soda salts, was leased by the state land board on Dec. 16 to responsible bidders on a royalty basis.

The West Coast mines of Bohemia district of Lane County are paying and 10 stamps of the 30-stamp battery have been running most of the year. The Vesuvius mining company has been an active property and Manager Hard has kept his 10-stamp mill running all the year. Robert S. Towne, of New York, owner of the Blue Ledge mine of Jackson County, is developing the property and will build a railroad from the mine to the railroad at Jacksonville.

The gypsum mines of Baker County produced 10,920 tons of gypsum.

*Newport, Ore.

Mining in Utah in 1914

By Edward R. Zalinski*

There was a steady output from the various camps during the first seven months, when mining operations began to be affected by the European war. Labor was plentiful, and there were no strikes or troubles of any kind.

The output of Park City was somewhat less than last year, owing to suspension of shipments by the Daly West, whose mill and hoist were destroyed by fire in 1913. Other Park City mines shipped a normal tonnage. The production of Bingham was less, but did not fall off as much as expected. The production from Tintic and Beaver counties decreased. The ore market in general was good.

PARK CITY, TINTIC, BINGHAM AND BEAVER COUNTY ORE SHIPMENTS, 1914

	Park City, Tons	Tintic, Tons	Beaver County, Tons	Bingham Shipments, Wet Tons
Jan.	5,674	30,082	.....	767,674
Feb.	7,480	27,467	.....	662,078
Mar.	5,590	31,861	.....	857,993
Apr.	5,289	28,712	.....	745,450
May	4,842	27,066	.....	820,246
June	6,511	27,377	.....	775,355
July	6,041	23,323	.....	778,834
Aug.	4,355	19,470	.....	504,892
Sept.	5,290	19,966	.....	391,465
Oct.	5,379	23,603	.....	396,054
Nov.	5,500 (a)	21,320 (a)	.....	384,561 (d)
Dec.	6,000 (a)	23,500 (a)	.....	400,056 (d)
Total 1914	68,951 (b)	303,747	51,550 (c)	7,484,458 (e)
Total 1913	81,822	370,240	81,641	8,326,000

(a) Shipments for November and December are estimated, but not from the average tonnage of the first ten months. They are based on the tonnage for September and October on account of metal market conditions affected by the European war. Shipments increased slightly in December.
(b) Crude ore and concentrates.
(c) Aggregate of shipments—monthly shipments not available.
(d) November and December partly estimated.
(e) Includes concentrates shipped by Utah Apex, Ohio Copper, and Bingham-New Haven.
Bingham shipments are over Denver & Rio Grande and Bingham & Garfield R.R. They also include ore shipped over the Utah Consolidated tramway, and Bingham & Garfield shipments (data furnished by courtesy of Utah Copper Co.). The shipments from Park City, Tintic, Beaver County and Bingham were obtained through courtesy of .he railroads.

The production from Alta increased. The principal shippers were the South Hecla, Wasatch Mines, Michigan-Utah and Alta Consolidated. On an average, three cars of silver-lead ore a day were shipped. During the latter part of 1914 an important strike of silver-lead ore was made by the Cardiff, in Big Cottonwood, which caused considerable activity in this section. The output of American Fork was the same as last year, averaging two or three cars monthly. The Miller Hill property was the chief shipper. At Stockton, the Bullion Coalition shipped 1000 tons of lead ore a month, and there were also shipments by lessees. The Hidden Treasure, in Dry Cañon, shipped two cars of zinc ore monthly, and about twice this amount of lead. The Cliff, Ophir Hill and Lion Hill Consolidated mines, at Ophir, made shipments. In Beaver County, the principal shippers were the Moscow, Horn Silver, South Utah, Lady Bryan, and Monitor. The South Utah suspended operations. The Sheep Rock, near Beaver City, produced gold.

Smelting Operations

The United States Smelting, Refining & Mining Co., at Midvale, ran four furnaces on lead ore. The coal mines of this company maintained a steady production. The Utah Railway, a new coal road, was completed, and put in operation under the Denver & Rio Grande. The Bingham and Tintic mines of this company produced as usual. The American Smelting & Refining Co., at Murray, had four lead furnaces in operation. The main stack was remodeled to the Wislicenus ventilating type, and the height increased from 200 to 300 ft. An experimental Cottrell plant for handling fume was tried. The company maintained an experimental farm near the smeltery, where accurate data were kept on agriculture and stock conditions. The Garfield smeltery of the A. S. & R. Co. operated two blast furnaces and four reverberatories. A Cottrell system was installed for handling 125,000 cu.ft. per minute of converter fume, and operated successfully. One reverberatory was remodeled to use powdered coal as fuel. The International, at Tooele, had five lead furnaces in blast and two copper furnaces up to October; after this, one copper furnace. A Cottrell plant was installed. During August, September and October, the smelters made provisional settlements for silver and copper, but resumed full payment soon after the first of November.

The output of the Utah Copper was approximately the same as last year, or slightly greater, notwithstanding the 50% curtailment which went into effect in August. During the first quarter there was produced 32,846,155 lb. copper; 40,017,562 lb. in the second, and 28,686,672 lb. in the third, making a total of 101,550,389 lb. in the first three quarters, as compared to 119,939,809 lb. during the whole of 1913. In the last quarter the monthly production was about 6,600,000 lb., or approximately 19,800,000 lb. for the quarter, making the total gross production for the year approximately 121,350,389 lb. The total ore treated at both plants in the first three quarters was 5,434,863 tons, as compared with 7,519,392 tons during 1913. Estimating the last quarter, the total output was approximately 6,492,800 tons. The grade of the ore was 1.3411%, 1.4573% and 1.4356% copper. Experimental work in flotation was done at the Magna mill, and 28 cells were installed to treat second-class concentrates. The Ohio Copper, at Bingham, discontinued operations.

Gold, Silver and Lead

Most of the gold produced came from copper, lead and mixed ores. The output was not greatly different than last year. Little straight siliceous ore was produced by Utah mines, except to a small extent by the Sheep Rock in Beaver County, and by the Annie Laurie, at Kimberley, in Piute County. The latter property began operating under lease in September, and shipped two cars of gold ore a month. Small shipments were made by mines near Marysvale. The production of the Sheep Rock was about $3000. Several properties in Tintic, including Victoria, occasionally shipped gold ore. The Centennial-Eureka produced from siliceous gold-silver ores. Fortuna, a new gold camp near Milford, in Beaver County, attracted attention. Gold ore was received by the smelteries from outside of the state, chiefly from Nevada.

The Silver King Coalition, Daly-Judge, and Silver King Consolidated, at Park City, producing silver-lead ores, and the Utah Apex, Bingham-New Haven, United States properties, and Utah Consolidated, at Bingham, producing lead-silver ores, were the principal shippers. The Daly-West rebuilt its mill and installed a new hoist.

*Mining engineer, Newhouse Bldg., Salt Lake City, Utah.

The Silver King Coalition built and equipped a large underground station on the Alliance tunnel level to carry on work at depth. The Daly-Judge put in an experimental Callow flotation plant in its mill to treat tailings. The Snake Creek drain and operating tunnel, which is being driven by the Daly-Judge, was advanced 3850 ft. during the year, leaving less than 4000 ft. still to be driven. On Dec. 2, the length was 10,152 ft. The Silver King Consolidated opened a large new orebody and installed machinery. The Utah Apex remodeled and enlarged its mill. The Centennial-Eureka, Chief Consolidated, Iron Blossom and Gemini, in Tintic, produced siliceous ores and lead ores.

The Mines Operating Co. produced silver by its chloridizing-leaching process from the stope fillings of the Ontario. Toward the close of the year, arrangements were made to install new roasters of the Holt-Dern type. The Park City Mills Co. remodeled the Grasselli zinc plant to treat siliceous ore from the American Flag and custom ore. The process consists of chloridizing leaching. This company operated in October, but closed down later to change its roasting equipment. The Knight Mill, at Silver City, treated low-grade Tintic ores by the Christensen leaching process. Toward the end of the year the plant was closed for changes.

Zinc

Zinc ores were mined at Tintic and Park City. The output from Tintic decreased, ore of this character being mined chiefly by lessees, who shipped 200 tons a month. The Daly-Judge was the principal producer at Park City. The tonnage of both zinc and lead ores produced by this company was the same as in 1913. The output of zinc in the form of concentrates was slightly less, but the grade was better, averaging above 40%. No zinc middlings were made. Lessees working tailings plants made occasional shipments. No zinc ores or concentrates were produced by the Daly West. The Hidden Treasure mine, near Stockton, shipped two or three cars of zinc ore monthly. The Huff electrostatic plant of the United States company treated 40 tons of zinc middlings daily from its Bingham and custom ores.

Uranium and Vanadium

The production of uranium and vanadium ores up to August amounted to 550 short tons. These ores ranged from 1½ to 2½% U_3O_8, averaging 1¾%.

The production from the Paradox Valley section, in southwestern Colorado, which is in the same formation as the Utah field, was 4000 tons of ore to Sept. 1. Of this the Standard Chemical Co. treated 3500 tons, averaging about 1%. The National Radium Institute treated 200 tons, averaging 2½% U_3O_8, and 300 tons running about 2% was exported.

The principal Utah producers were the Standard Chemical Co., operating near Hanksville, in Wayne County, 110 miles south of Green River. This company shipped 50 tons, running about 2%, to its plant near Pittsburgh. The Radium Co. of America, operating on the San Rafael Reefs, 14 miles south of Green River, shipped about 50 tons to its plant near Sellersville, Penn., and sold 200 tons to the Consolidated Ores Co. These ores carried around 1½% U_3O_8. Senator T. Kearns did work on claims in San Juan County, near Monticello, 80 miles south of Thompsons; no shipments were made. The Consolidated Ores Co., of Salt Lake City, formerly David Taylor & Co., produced from claims in Emery, Grand and San Juan counties 200 tons, running 1¾% U_3O_8 and 6% V_2O_5. This company also shipped a ton of high-grade ore, carrying 17% U_3O_8, and 400 lb. running 31%. The latter is probably the highest-grade shipment of ore of this character yet made.

Metal Production

The aggregate metal production from Utah and custom ores smelted by the United States Co., the American Smelting & Refining Co., at Murray, the Garfield smeltery of the A. S. & R. Co. and the International was:

Lead	238,610,739 lb.
Copper	145,071,710 lb.
Silver	16,018,147 oz.
Gold	207,459 oz.

The output for December is estimated. Arsenic was produced by the United States company as a byproduct. Sixteen Utah mines paid dividends totaling $6,966,118.

Alaskan Mining in 1914*

The year 1914 saw a number of events of great importance to Alaska, and consequently to its leading industry, mining. Among these were the passing of the railroad bill, the passing of the coal-land leasing bill, the entrance of the Granby company into the mining field, the continued tremendous activity in the Juneau district and the announcement of the existence of important low-grade prospects in the Broad Pass region.

As for production, the most accurate reports indicate a slight falling off in value for 1913, due to the decline in the price of copper. Favorable weather permitted a successful season in the interior placer fields and those of the Seward Peninsula. The lode mines in general showed a healthy activity. The value of the total mineral output of the territory is estimated at $19,248,000, compared with $19,416,000 for 1913. As heretofore, gold is the most important product, its value being $15,900,000, as against $15,626,813 for 1913. The copper production is placed at 20,850,000 lb., as against 21,659,958 lb., its value, however, showing a greater decline. The output of tin, marble, gypsum, quicksilver, coal, petroleum and silver shows a slight decrease in estimated value over that of 1913. Of the gold the placer production was $10,700,000.

*Taken in part from advance statement of the U. S. Geological Survey.

Southeastern Alaska

Developments in the Juneau district continued at a steady rate through the year. The first of the great new properties, the Alaska-Gastineau, was about ready for initial production on a large scale at the end of December. The main features of its work for the year included the completion of the Sheep Creek tunnel, of the Salmon Creek dam, of the coarse-crushing plant, and the practical completion of the first unit of the milling plant; the re-

construction of the haulage system between the mine and the treatment plant; a large amount of development work in the orebodies; and the outlining of large new deposits reported to have increased several-fold the probable tonnage in reserve.

The other definitely undertaken enterprise on the mainland, the Alaska-Juneau, continued mine development during the year along the lines previously laid down, and also did a good deal of construction work and installed machinery. The first unit of the mill, consisting of 50 stamps, was completed, and the mill should be operating to full capacity in the spring; it is expected that a capacity of not less than 20 tons per stamp will be obtained.

The U. S. Smelting, Refining & Mining Co. prosecuted its development work diligently on the Ebner group. There is no information available on the results of this work, but it is reported that several hundred thousand dollars has been spent to date. The work included the completion of a crosscut tunnel to the orebody and the testing of samples in a small mill.

Across Gastineau Channel the Treadwell group continued its steady production, as heretofore. The Seven-Hundred mill was increased by 30 stamps, the 300-Stamp mill of the Treadwell was electrified, and plans were made for adding to the power plant and electrifying the 240-Stamp mill of the Treadwell. A central shaft and crushing plant started operations, handling ore from the Treadwell, the Seven-Hundred and the Mexican mines, at the rate of about 4000 tons per day. Development work underground included connection of this central shaft with lower levels of the three mines. A new incline shaft was begun for the Ready Bullion.

North of Juneau, in the Berners Bay district, operations were continued at the Kensington mine, including the completion of a 4700-ft. adit entrance; plans were also made for a mill. At the Jualin mine, under option to the Algunican Development Co., representing Belgian capital, development work was pushed for a while and some fast driving done on an adit entrance, but it was reported that a shutdown became necessary after the outbreak of the war. Latest reports indicate that the mine is to be reopened. During the year operations were started in a 10-stamp mill.

Around Ketchikan the Rush & Brown property, on Prince of Wales Island, continued work throughout the year; but the war caused a cessation of operations on practically all the other mines in the district. This is true of the Jumbo and of the Granby properties. The latter company now owns the Mamie and the Dean, and has an option on the It.

In the Porcupine district three hydraulic plants were operated. The Chichagof gold mine ran throughout the year. Some development was carried on in the Wrangell region.

Copper River Activities

A record production would have been made by the copper properties in the Copper River region, but for the break in the price of the metal. The Kennecott Mines Co. curtailed its production to such a point that at the end of the year it was not operating its concentrator, but merely shipping high-grade ore from the Bonanza and Jumbo mines, each of these working at about half capacity. The Jumbo, which began producing regularly in December, proved to be equal to the Bonanza itself, or to surpass it, both in richness and in quantity. The reduction to half capacity is in reality a reduction to about 25% of the potential production of the company.

Among the other companies, the Mother Lode continued active operation and made some valuable discoveries. The Hubbard-Elliot continued its work, and the same is true of the Alaska Consolidated, the Great Northern and the Rarus group. Hydraulicking went on in the Nizina and the Bremner districts. Nelchina has proved rather a lemon; only a little pay gravel has been found and the gold production to date is insignificant.

Along the Coast

In and around Prince William Sound two copper mines and five gold lode mines were operated. The Beatson Copper Co., on Latouche Island, about completed its new concentrator, from which production was expected to begin on Feb. 1, 1915. This mill embraces both gravity and flotation methods. New concentrate bins and docks provided with a conveyor belt for loading were erected. The mill is connected with the mine by means of a 2000-ft. tunnel, but mining is done in an opencut. About 50,000 tons were mined and shipped during the year. After February most of the production will pass through the concentrator, the capacity of which is about 700 tons.

The Ellamar during the year completed an aërial tramway connecting its shaft bins with deep-water loading facilities and having a capacity of 200 tons per hour. The discharge station is 2200 ft. out in the bay from the loading station, and the system required the erection of six towers. The year's production of the mine was about 50,000 tons, which might have been greatly increased if market conditions had justified. The Threeman Mining Co., on Landlock Bay, developed through the year, and has several hundred tons of copper ore ready for shipment. No attempts were made to take out ore except as required in development work. The property is under option to the U. S. company, which sampled it late in the summer. The Midas, now owned by the Granby company, was vigorously developed.

In the Port Wells district, the Granite mill was operated most of the year with good results. Developments here disclosed that the orebody continued in an entirely satisfactory way. The Golden Eagle installed a mill. Near Valdez a mill was constructed on the Ramsey property and another on the Big Four. The Mountain King milled a few hundred tons. The Cliff gold mine was operated during the first of the year. Gold was also produced in the Cameron & Johnson and Gold King properties. On the Kenai Peninsula, the Skeen-Lechner and Palmer Creek mills operated part of the season, and other mines were developing.

Susitna Basin

One of the most striking occurrences of the year was the announcement of the discovery of large bodies of low-grade ore, principally gold bearing, in Broad Pass, between the Susitna River drainage and the Yukon system drainage. It is uncertain as yet just what ore exists there, and what its availability may be. It is generally admitted that the deposits are low-grade and their successful exploitation will depend upon the entrance of the Government railroad to or near the district. It appears, also, that the deposits carry large quantities either of antimony or of arsenic.

The Willow Creek district experienced a successful year, work being conducted on a larger scale and the output being increased over that of 1913. The Alaska Free Gold was a large producer, together with the Alaska Gold Quartz and Gold Bullion. The Gold Bullion installed a cyanide plant.

On Valdez Creek the Valdez Creek Placer Mines completed the installation of its hydraulic outfit and did a month's work before the close of the season. Considerable difficulty attended the transportation and erection of this plant, and its successful accomplishment is a notable achievement.

Fairbanks

Fairbanks had a discouraging year; there was a late start in the spring; the quartz mines were not particularly successful, and the abundance of water, while favorable in general, hindered opencut operations. The decrease in production was about $500,000 from that of 1913 and is variously estimated around $3,000,000. A notable feature of the work was the increase in the number and size of power-scraper plants, there being about 15 of these at work. This method promises to become important in the Interior, being especially applicable to shallow, low-grade ground, too limited in extent to justify a dredge. Costs run only about half as much per square foot as in drift mining.

Most of the Fairbanks production still comes from drift mines, those at Chatanika doing especially well. Jack Prest, on Upper Vault Creek, discovered some phenomenally rich pay during the winter, the streak being 60 ft. wide and averaging $6 to $8 per square foot.

The Rhoads-Hall quartz mill was the only one of 15 which ran continuously. The Willis ran intermittently on custom ore for a while and was later bought by Crites & Feldman and installed on their property, starting operations in September. This property has also installed a compressor and drills and is the second in the district to become a steady producer and give promise of long life.

Despite the encouragement given by the passage of the railroad bill, Fairbanks operations were curtailed on account of an advance of about 25% in the price of provisions following the purchase of the Northern Navigation interests by the White Pass company. Extremely dull times are looked forward to until the government railroad actually enters. Since the per capita yield of the mines during 1914 was only about $700, figuring the population at 4000, it is evident that the district is over-crowded—but in the towns, not in the mines.

Other Upper Yukon Districts

In most of the upper Yukon districts operations went on about as in the preceding year, but the Hot Springs had the best season of its history. It appears probable that the total production was nearly a million dollars. Most of this increase resulted from the extensive drilling carried on by Bock on the deep ground of lower Sullivan Creek during the last two years.

In the Circle district production was probably about $200,000; most of the work here is hydraulicking and an abundance of water was of great help. Among the principal plants operating were the Mammoth Creek, the Berry plant on Eagle Creek, and Jensen & Herrington on Lower Mastodon. The Elmer dredge on Mastodon was found unsuitable for the work and, after getting into financial difficulty, was sold. The C. J. Berry Dredging Co. acquired the properties of the Mammoth Creek Mining Co. and those of Jensen & Herrington on the lower end of Mastodon and Independence creeks; it landed a dredge at Circle during the summer and is freighting the material over to Mammoth Creek during the winter, for erection. A combination steam shovel and washing plant was installed on Independence Creek, the washing end comprising a screen, sluice tables, etc. Its success is not known.

The Koyukuk had a gain over 1913 showing a total production of about $280,000. The Chisana district appears to have established itself as a small, steady producer. Its yield is estimated at about $250,000 for 1914, coming chiefly from Bonanza Creek. During the year good prospects were found in the Healy River drainage, and late in the summer reports of discoveries at the head of the Tolovana River caused a small stampede. Definite information on the find is still lacking.

Lower Yukon Points

Ruby is considered by most well informed mining men of Alaska the coming interior placer camp. It seems probable that its 1914 production was about $1,000,000, a gain of almost 75% over 1913. Development is retarded by the lack of suitable roads, together with the high freight rate prevalent in the Yukon drainage region. Long Creek was a leading producer, together with Flint, Birch and Bear Pup. Drilling will be done on Big Creek about five miles from town during the winter. It is stated that a Union Construction dredge is to be built, having 3½-cu.ft. buckets, for operation in the district next season.

The Innoko-Iditarod region had an excellent year and yielded probably $2,200,000. There were two dredges in operation, one on Flat Creek and one on Otter Creek. That of the Yukon Gold produced $734,000.

Seward Peninsula

The Peninsula, in general, had a good year. Many of the dredges were operated at a loss, as heretofore, but the production was increased substantially over 1913, with a total somewhere between $2,700,000 and $3,000,000. Several new dredges were built, the total number of gold dredges now being 41, 11 in the Nome district, 10 in the Council, 9 in the Solomon, 5 in the Teller, 4 in the Kougarok, and 2 in the Candle and Inmachuck. Water was abundant and the hydraulic companies, as well as the small operators had a good season. Tin mining seems to be progressing. One dredge, that of the York Dredging Co., operated all the year and produced a greater tonnage than in 1913, but obtained a smaller price. Two other tin dredges operated part of the year, and a good deal of work was done on the Lost River lode tin mine. A small reduction plant run by gasoline was used here for testing, and announcement has been made of the contemplated erection of a 60-ton mill in 1915.

Other Regions

In the Kuskokwin Basin a good deal of prospecting was carried on. Copper and quicksilver showings have been found, as well as gold. Late in the year came reports of an important strike made on the Aitken & McKinnon property, on Candle Creek. The Kobuk region made a substantial production, and it is reported that increased activity may be expected here next year.

The railroad commission began work promptly after its appointment and finished a large amount of surveying before the season closed. It is understood that strong recommendations will be made for the building immediately of a railroad from a point somewhere around Seward, through Broad Pass, to the Fairbanks region.

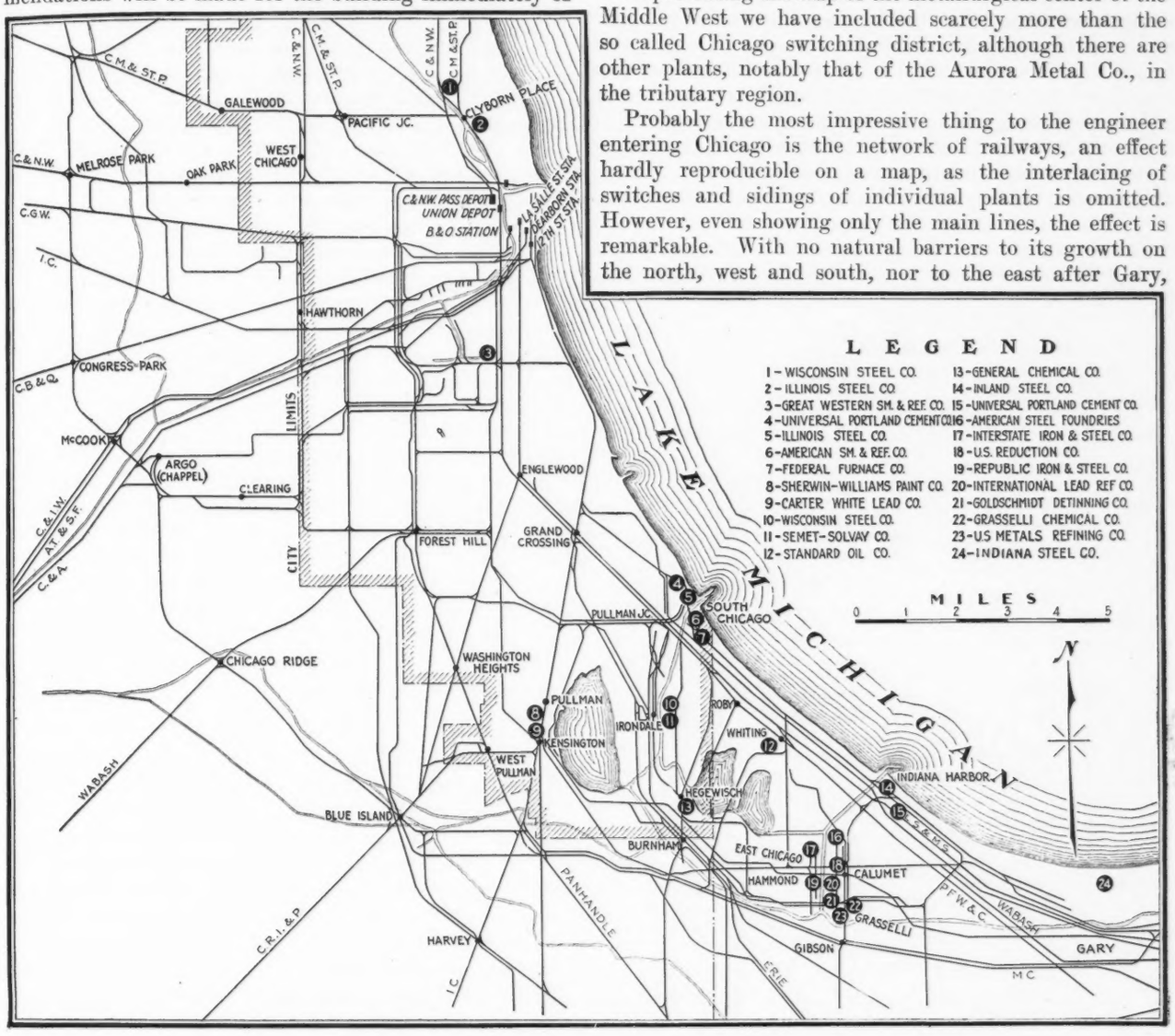
As in 1913, Juneau during 1914 recorded the most vigorous development and substantial promise of any Alaskan district. Alaska-Gastineau and Alaska-Juneau may be considered now as producers, while it seems highly probable that the U. S. interests will take over the Ebner. Other groups in the district are being examined, and representatives of many large mining companies have looked the camp over during the year.

The coal-leasing bill is expected to open up the coal fields for exploitation, and cheaper power may be looked forward to in many of the mining districts thereafter. Latest reports are to the effect that the Matanuska coal-steaming-tests made on the Maryland were satisfactory. Available coal and reasonable freight rates will unquestionably prove a boon to the Interior, encouraging the development of lode mines and bringing to placer mining a new lease of life.

Chicago, the Middle West's Metallurgical Center

In presenting the map of the metallurgical center of the Middle West we have included scarcely more than the so called Chicago switching district, although there are other plants, notably that of the Aurora Metal Co., in the tributary region.

Probably the most impressive thing to the engineer entering Chicago is the network of railways, an effect hardly reproducible on a map, as the interlacing of switches and sidings of individual plants is omitted. However, even showing only the main lines, the effect is remarkable. With no natural barriers to its growth on the north, west and south, nor to the east after Gary, with cheap fuel and iron ore, situated between the Western smelters and Eastern markets, who can estimate the coming importance of Chicago in metallurgy?



METALLURGICAL MAP OF CHICAGO AND ITS ENVIRONS

Bismuth in 1914

Bismuth, so far as we can learn, was produced in 1914 in quantity by only two firms in the United States: The U. S. Smelting, Refining & Mining Co., as a byproduct of electrolytic lead refining; and the American Smelting & Refining Co., which extracts the bismuth (by electrolysis, it is claimed) from an enriched bullion obtained by steam pattinsonizing. It has also been stated that the National Lead Co. recovers bismuth from its residues, but this report cannot be confirmed.

The price in January, 1914, was $1.80 per lb. for foreign bismuth; $1.72 for domestic. Owing to interruption to Bolivian and Australian trade it jumped to $2.85@3, and closes the year about $2.85.

Mining in Ontario in 1914

By Thomas W. Gibson*

The value of the mineral output of Ontario in 1914 was about $50,000,000, being 3 or 3½ millions less than in 1913.

The decrease was in large part due to the war, the shock of which partially paralyzed capital, lessened demand, and so lowered prices and diminished production. The silver industry felt the blow severely, and it was feared the mines at Cobalt would be closed. However, the intervention of the Canadian Government induced the banks to make advances as against bullion, which for a short time was unmarketable. Confidence was gradually restored, but the steady recession of the price of silver, a process which had set in even before war was declared, led many of the companies to restrict their output. In any event, the yield of silver would have been less than in 1913, it being now recognized that the maximum stage of productivity at Cobalt has been passed. As the figures given below will show, the relative fall was greater in the value of the returns than in the actual output.

The influence of the war was felt also by nickel mining, but the effect was different upon the two producing companies. The Canadian Copper Co., whose matte is refined in New Jersey and whose market for the refined metal was in Europe as well as America, reduced the number of furnaces in blast from six to two, though later it raised it to four. On the other hand, the Mond Nickel Co., which sends its matte to be refined in Wales, was enabled by means of its new plant at Coniston largely to increase its output. The capacity of the Mond works is less than that of the copper company, hence there is a decrease, though not a serious one, in the quantity of nickel produced as compared with 1913.

Notwithstanding the falling off in nickel, the yield of copper, which is a byproduct of nickel, was considerably increased. The reason for this was the larger scale of the Mond company's operations, its ore containing a larger proportion of copper, though less of nickel, than the ores smelted by the Canadian Copper Co. Another result of the war was the closing of the markets in continental Europe for cobalt oxide, in the production of which Ontario now leads the world.

The year was marked by a large increase in the amount of labor offering in the mines, which is now in excess of the demand. Managers remark that for this reason it is more efficient. There was no reduction in the scale of wages, however, either for this reason or because of the introduction of the eight-hour underground-labor law, which became effective Jan. 1, 1914.

The death rate from accidents in the metal mines of Ontario remains high notwithstanding strict government inspection and investigation, as required by law, into every fatality. In 1913, the death rate per thousand in the mines, quarries and metallurgical works was 3.34 per thousand men employed and for 1914 the rate was practically the same. Some of the larger companies are employing a safety engineer to keep down accidents. In this way the Canadian Copper Co. reduced its fatalities from 11 men killed during the first half of 1913 to 3 during the latter half and to 1 in 1914. The company's safety engineer, E. T. Corkill, was appointed July 1, 1913. The Workmen's Compensation Act came into force Jan. 1, 1915, and by virtue of its provisions all accidents, fatal or otherwise, will entitle the injured person to compensation on a prescribed scale.

*Deputy Minister of Mines, Toronto, Ont.

Gold

The yield of gold was about 270,000 oz., value, about $5,400,000. This is 50,000 oz. more than in 1913. The greater part came from the mines of Porcupine; a little less than half, say 125,000 oz., from the Hollinger mine, now rapidly claiming a place among the great gold mines of the world. Monthly dividends amounting to 39% and aggregating $1,170,000 were paid out by the Hollinger last year. A representative run for the four weeks ending Nov. 4 showed 18,645 tons of ore milled, the average value of which was $14.09 per ton. The allied Acme company is developing the adjoining Dixon and Millerton claims, and 40 stamps and a separate cyaniding plant are being installed in the Hollinger mill to treat the ore. Dome mine, the next largest producer, is essentially low-grade, but the bodies are large. Some 205,000 tons of ore were milled last year yielding about 51,000 oz., or $5 per ton. Porcupine Crown and McIntyre Porcupine milled considerable rich ore, and were important factors in the production. Tough-Oakes at Kirkland Lake continued development of its narrow but rich veins, and is building a new mill.

Silver

The output of the Cobalt mines was about 25,000,000 oz. of silver, worth $12,765,000. As compared with 1913, this is a falling off of about 4¾ million ounces in quantity and 3¾ million dollars in value. High-grade ore no longer plays the chief rôle at Cobalt, though it is by no means obsolete. Concentration of low-grade material is the chief feature of Cobalt practice; production of merchantable bars is another. Both features are embodied in the new low-grade mill opened by the Nipissing company last year. The chief producers continue to be Nipissing, Coniagas, La Rose, Crown Reserve, McKinley-Darragh-Savage, Seneca-Superior, Kerr Lake, Buffalo, etc. Townsite moved up into third place, having uncovered some very rich ore. The unwatering of Kerr Lake has proved to be a somewhat heavy job, largely because of the great depth of mud resting on the bottom. The work was not completed before winter set in. A similar process is going on at Cobalt Lake. In some of the mines there is much broken ore stoped out and awaiting an advance in the price of silver; in the vaults of others silver bars are accumulating. If the price should move up in time to influence the operations of next year, it is easily possible that the production of 1915 may equal or surpass that of 1914. The greatest depth from which silver is being obtained is at the Temiskaming mine, where a good vein was struck in the diabase at 750 feet.

Nickel and Copper

Nickel contents of bessemer matte are estimated at 22,000 tons, worth $4,900,000, and copper contents 14,250 tons, worth $2,000,000. The Canadian Copper Co. some

time ago believed its great Creighton mine was approaching the point of exhaustion. Consequently, the huge but lower-grade deposit known as Frood or No. 3 mine was opened up, a town was built by the company for its workmen, and operations on a large scale begun. The diamond drills which meantime had been exploring the Creighton, reported the existence of large reserves previously unknown. Work was stopped at the Frood, and again the company is drawing its main supply from the Creighton mine. The Alexo mine in Dundonald township which had been shipping ore to the Mond smeltery discontinued consignments when war was declared, but has since resumed them.

Iron ore to the amount of about 180,000 tons was raised at the Helen, Magpie, Moose Mountain, and Canada iron mines, the value being about $400,000. Of pig iron, some 650,000 tons were made at the Sault Ste. Marie, Hamilton, Port Colborne and Deseronto blast furnaces, the value of which was $8,450,000.

Nonmetallic Materials

There is a great variety of nonmetallic substances produced in Ontario, such as building materials, including brick, lime, stone and portland cement; petroleum and natural gas, also salt, mica, corundum, talc, iron pyrites, quartz, feldspar, graphite, etc. The combined value of the nonmetals produced in 1913 was between 15 and 16 million dollars, and in 1914 was about the same, or possibly a little less.

Mining in British Columbia in 1914

The demoralized metal market had a profound effect on British Columbia mining. This is particularly true of the interior, where the smelting companies were shut down altogether for a while, so far as known, although later some resumption of activity took place.

The British Columbia Copper Co. blew out its plant in August, and also shut down its mine. At its Mother Lode mine in the Deadwood camp, about 178,000 tons of ore was mined, at the low figure of 85.48c. on board cars. A slight increase in cost here is due to the necessity of mining more ore by stoping instead of by glory-hole methods. Up to Aug. 20 the company had smelted 295,000 tons, of which 191,000 was company ore, the balance being custom ore. Something over 4,000,000 lb. of copper was produced, 14,442 oz. of gold and 63,501 oz. of silver. The company is operating a group of claims with about 25 men at Copper Mountain, 12 miles south of Princeton, in the Similkameen district. The result of the work here indicates a reasonably assured reserve of 5,000,000 tons and more, with excellent chances for this to be increased. The Granby closed down its Phœnix plant somewhat earlier than did the British Columbia, but resumed operations again on a reduced scale; it is rumored that a gradual increase to full capacity is planned. The Consolidated Mining & Smelting Co., at Trail, resumed the acceptance of shipments in October, making partial payments for the contents of custom ore with arrangements for later complete payment.

In the Slocan district the leading company continues to be the Standard Silver-Lead. This company continued its splendid performance of the last two or three years until August, when at the beginning of the war a partial cessation of underground work was found necessary. During this period of curtailment the company shipped no lead, but attempted to take advantage of the high zinc market while it lasted, by shipping such blende as was valuable. It is reported that this attempt was later given up and all work stopped except development work.

All the Slocan mines suffered more or less reduction of operations shortly after the outbreak of the war, partly the result of financial difficulties, and partly due to the fact that the Consolidated would accept no lead ores. The resumption of operations by the latter company, under restrictions, was not in all cases satisfactory to the ore vendors, who were probably rather unreasonable in their demands. The Van Roi, which is owned entirely in England, ceased operations, although during the year it had been extracting and treating ore from a new orebody, the best so far discovered in the mine. The Lucky Thought, adjoining the Van Roi, was explored under option for the Consolidated with encouraging results.

The Silverton Mines, Ltd., owner of the Hewitt, started its flotation concentrating process in the spring. It is reported that Minerals Separation, Ltd., financed the installation of the mill, and also that the process was not so successful as had been hoped. The Slocan Star found some good ore on its lowest level and shipped some before resorting to development only at the beginning of the war.

More interest was shown in the coast developments during the year than in the interior. The Britannia Mining & Smelting Co. at Britannia Beach continued its extensive program of development and construction.

The Granby Consolidated Mining, Smelting & Power Co. blew in its Anyox smelting plant on Mar. 16, on ores from its Hidden Creek mine. Development work was carried on at the mine and surface construction was pushed practically to completion. The plant consisting of mine, smelting works, railroad and town, is an extensive modern installation. Certain troubles naturally to be expected were encountered when the furnaces were first blown in, but were rapidly overcome. The Granby company engaged in a strong campaign to develop tributary ores along the coast; to that end it took over three mines in Alaska and has another under option. It also has a working option on a group of old mines at Van Anda, Texada Island, north of Vancouver.

The Tonopah-Belmont interests have organized the Belmont-Canadian Mines, Ltd., for the purpose of carrying on mining and exploration in British Columbia. The directors, officers and staff correspond about to those of the Tonopah-Belmont itself. The most important undertaking of these interests is the taking under option of a gold property at Surf Inlet; the option, acquired in April, 1914, expires July 1, 1915. The company instituted a campaign of development work involving a considerable amount of surface construction, and it is believed that results are favorable up to date. The property is opened with adits and should be amenable to economic exploitation. It is understood that the ore is not of high grade, but that the deposit is wide and indicates considerable extension, both lateral and in depth.

In the Atlin district, in the extreme north of the province, production was about the same as heretofore, although the camp experienced rather more activity than has been its lot for some years.

Mining in Mexico in 1914

Mexico has been doubly unfortunate during the year, since her own revolutions removed the element of stability and made mining economically almost impossible, and then the European war appeared to make conditions worse, if possible.

Conditions at Cananea

At Cananea the Cananea Consolidated Copper Co. operated from the first of the year to the middle of July, except for two short intervals. Owing to lack of suitable railroad bridges and governmental or other responsible authority, it was not possible to operate the property on a regular producing basis in the latter half of 1914. However, some work was done, about 350 men being on the pay-roll at the end of the year. The pumps were kept running, hand drilling was done at various points and the works maintained in good order. The properties are in charge of George Kingdon, as general superintendent, but only a few other Americans were required on the staff at the end of the year.

Two of the Mexican properties of the Mines Co. of America resumed operations in June, 1914, and operated at about three-fourths capacity during the remainder of the year. The properties which resumed work were El Rayo, in Chihuahua, and Creston-Colorada, in Sonora. La Dura, in Sonora, and Dolores, in Chihuahua, were not operated, since railroad transportation was completely interrupted at the former and nearly so at the latter.

Smelteries in Northern Mexico

At Chihuahua the mines and smelteries were troubled a good deal by revolutionary activities and most of the mines were necessarily closed during a portion of the year. The same applies to the Parral Camp, at which a combination of transportation difficulties and revolutionary activities made cessations of operations necessary. At present only the Alvarado is running. Many of the Parral mines have been allowed to fill with water, which will have to be pumped out before production can be resumed.

It was reported about Dec. 20 that zinc and silver mining was becoming active again in the northern part of Mexico, and that the smelting plants were about to start up. The El Paso plant was running two lead furnaces on ores received from the surrounding country. The smeltery of the American Smelting & Refining Co., at Chihuahua, was running four of the lead furnaces steadily, while the balance of the furnaces were idle on account of scarcity of labor, therefore restricting the shipment tonnage of custom ores. At Torreon the smeltery of the Compañia Metallurgica de Torreon was running and receiving custom ores. The Asarco plant of the American Smelting & Refining Co. was also running again and receiving custom ores. These companies operate works treating lead-silver ores principally.

As a result of the better tone in the metal market, several of the mines of the Santa Eulalia district, near Chihuahua City, were starting operations again. The San Antonio, of the A. S. & R. Co. has been started up under lease to Schuyler Lawrence, shipping lead and silver ore to the smelteries. El Cristo Mining Co. is also taking out ore and shipping to the smelters. The two big mines of the Cusihuiriachic district are operating. The Cusi Consolidated is doing development work and taking out ore, and the Cusi Mining Co. is working, but with a smaller force than formerly and shipping to the Chihuahua smelter.

Tigre Plant Operating Continuously

With the exception of seven days, from Apr. 24 to May 1, during which time the American employees were out at camp owing to the difficulty caused by the occupation of Vera Cruz by United States soldiers, the Tigre, at Esqueda, Sonora, has been in operation continually during the year, and has not suffered in any way from the disturbed conditions in the country. During the seven days referred to, work in the mines went on as usual, but the mill was partly closed. The only mine of the district which was compelled to cease operations was El Temblor.

The North Tigre was leased to the United Mines Co., and the 50-ton mill completed. The Cinco de Mayo properties, about 15 miles northwest of Esqueda, have been operated during the year by the Constitutional authorities. Their revenue, for most of the time, was from ore produced which was shipped to El Paso.

Along the border, south from Nogales, there was some prospecting and some working of the small properties. Minas Prietas, the largest camp in the district, was in operation part of the time, and at present is increasing its scale of operations. There have been many small shipments of ores from different smaller prospects, but nothing of much interest.

Central Mexico Operations

At Zacatecas operations were held up for a considerable period, owing to revolutionary disturbances and actual fighting. La Fé Mining Co., Ltd., at Guadalupe, just below the City of Zacatecas, practically completed its construction work during the year, but operations have continued to be hampered. The mill was started early in April, but was in operation less than a fortnight when the political situation became so menacing that all work, with the exception of pumping, was stopped, and all of the foreign staff left the property, a Mexican engineer taking charge temporarily. At present the mine is kept unwatered, pending the advent of conditions giving some assurance of continuous operation. A. B. Emery resigned the management, and E. A. Strout, previously assistant at the Santa Gertrudis mine, was appointed to take his place.

Operations at the Palmarejo & Mexican Goldfields, Ltd., have been halted by the political troubles, and it is impossible to say when they will be resumed. When the revolutionary movements reach a definite end, it is hoped that the capital necessary to start milling operations will be raised. The manager is holding himself in readiness to return to Mexico as soon as conditions permit.

The Mazapil Copper Co., Ltd., in Zacatecas, has done no work during the year, and practically all operations in the district have been suspended, awaiting better conditions.

The Cia. Minera de Peñoles has not done any work at Ojuelo, Durango, since September, 1913, but blew in the smelting plant at Mapimi this fall, on custom ore, though it is not running at full capacity.

Situation at El Oro

At El Oro, in the State of Mexico, the difficulties of operation have been many. The mines all continued operations at the usual rate until the end of April, when the Vera Cruz incident necessitated all foreigners leaving the district. Mills were closed down, but in order to keep Mexican workmen employed, development work was continued. No trouble was experienced, and this work was carried out satisfactorily under the direction of the company's officials in Mexico City until about Oct. 1, when dynamite was getting scarce. About this time the Carranza administration made it plain that the mills must resume operations and production. There was serious objection to this, as some officials had assumed authority to take possession of the bullion in transit or in Mexico City, and the scarcity of dynamite prevented operations at the usual capacity.

Mills of the El Oro Mining & Railway Co., the Esperanza Mining Co., and Mexico Mines of El Oro, started up at a moderate rate, using ore which was broken and retreated tailings to some extent. These operations have been continued, though at the present moment dynamite is scarce and no supply has arrived.

The Dos Estrellas Mining Co. continued development work without making any resumption of milling operations, employing about half of their men. La Lucha mine, in the same district with Dos Estrellas, started milling operations for the first time in August, and has continued its work steadily.

The output for the El Oro mines for the year will be approximately as follows:

EL ORO PRODUCTION IN 1914

	Tons	Production
El Oro M. & R. Co.	229,200	$1,317,800
Esperanza	173,800	1,060,000
Mexico Mine	61,600	868,000
Dos Estrellas		2,180,600
La Lucha	4,500	73,700
Total	469,100	$5,500,100

The output in 1913 was 829,700 tons with a production value of $13,002,450.

The outlook for January is somewhat uncertain, but if supplies of dynamite and cyanide can be obtained, work will be continued and resumed at full capacity as soon as possible.

Pachuca Mills Running

At Pachuca the conditions have been similar to those in the El Oro district. All the American staff was driven out at the time of the occupation of Vera Cruz by United States troops, but the Real del Monte company continued on a reduced scale under their Mexican staff, at no time dropping below 700 tons per day milled. In August most of the Americans returned and work is now being gradually brought back to the old basis. The normal capacity of the Real del Monte equipment is about 1800 tons per day. The other companies closed their mills entirely for a period of two to four months, while maintaining a certain amount of underground work to keep some of their men occupied.

It is understood that Pachuca was taken by assault by Villa forces a short time ago, and that now all is quiet and the new authorities are extremely anxious for re-establishment of full-scale operations as soon as possible. There has been some shortage of supplies, but the companies have assisted each other as far as possible. Efforts are being made to provide trains for carrying necessary supplies in to the camp via El Paso.

It is worthy of mention that at no time have the workingmen employed by any of the mining companies in Pachuca taken any part in the disturbances which have occurred, but on the contrary have done everything in their power to be of protection and assistance to American employers against the irresponsible mobs not employed by the companies.

Santa Gertrudis mill was closed on Apr. 21, 1914, and resumed operations in August at a scale estimated to pay the administration and to employ a sufficient number of workmen to safeguard the property. Development on the lowest level is said to have been disappointing, but some good orebodies parallel to the main vein have been discovered. In September operations were increased to 85% of normal and there held for the balance of the year. It is not intended further to increase production until a more certain supply of cyanide can be arranged, and pending an improvement in Mexican and foreign general conditions.

Guanajuato Short of Supplies

At Guanajuato there have been a good many difficulties, but in general there have been very few cessations. The Guanajuato Consolidated Mining & Milling Co. ran the full 80 stamps up to April, but since that time only half of them have been running. The Guanajuato Reduction & Mines Co. has operated the Bustos mill and the Flores cyanide plant continuously. The Guanajuato Development Co. has operated its principal mines and mills, but development and nonproductive work have been reduced to a minimum. The Carmen mill, belonging to the Guanajuato Con., was shut down during July, August and September, but has been in operation since that time. No new work has been undertaken in the district during the year. It has been difficult to secure supplies, but somehow it has been done. At present it is possible to get supplies by way of El Paso.

Reports from the Balsas River district in Guerrero indicate that some of the American-owned properties are in the hands of rebels under Salgado, who are trying to force operations on it. With most of the properties it is impossible to do them any great harm by robbery of this sort, but at at least one of these mines, operations are being carried on on a generous scale, sufficient to supply the rebels with considerable money.

The Jalisco Properties

The Hostotipaquillo district, of Jalisco as a whole operated until about the end of April, when an attack was made by bandits at several properties. At El Favor, which closed on Apr. 25, the manager, Walter Neal, and another member of the staff, Patrick Baird, were stabbed, and two of the staff, C. B. Hoadley, an American, and G. E. Williams, a British subject, were killed by the bandits, who looted the stores and stole considerable bullion. Prior to this the company had declared two dividends, amounting in all to $70,000. Since April it has been impracticable to get supplies to the mine and no operations have been undertaken. The mill, containing 35 stamps and 5 tube mills, has a capacity of about 180 tons when grinding through 200 mesh, but it is expected that the mill capacity will be increased by application of the Field process when operations are resumed.

The Casadas and the Mololoa mines were operated during the first quarter of the year, while the Cinco Minas property of the Daly Estate started its mill in February but was compelled to cease operations after April. The Amparo mine at some distance from the others, was subject to less interference, and at the last date of communication, Nov. 7, was operating.

Eastern Guanajuato

Mining and milling in the eastern part of the State of Guanajuato, particularly in the Pozos district, has been carried on with little interruption. This territory is far removed from the seat of revolutionary troubles, and since the people are generally peaceably inclined and live in an agricultural district, there has been little difficulty in continuing the work. The mill of the Cia. Beneficiadora de Pozos, under which name the new large mill of the Angustias Company has been constructed, was operated practically continuously during the year. Some difficulty was experienced as to the mill's capacity, it having fallen somewhat below expectations. Late in the year, however, a study of conditions was undertaken with the object of removing the difficulty.

The districts of the west coast have been, like all other districts in Mexico, operating under difficulties, if at all. Development at Bolaños was interrupted and nothing is being done with it at the present time. At Copala, Panuco, Rosario, Guadalupe, de Los Reyes, and many other small camps through Sinaloa, Sonora, and farther south, operations were spasmodic or entirely absent. On the east coast, the mines of the Victoria, Tamaulipas, were discontinued altogether.

At San Luis Potosi the smeltery of the Cia. Metalurgica Mexicana was closed during most of the year, and its principal supplying mines, the Victoria, at San Pedro, have also been closed. At Charcas the properties of the A. S. & R. Co. have commenced work again, and efforts are to be made to continue.

The large mines of Santa Rosalia, in Baja California, continued operations during the year with little interruption. There has been comparatively little trouble through revolutionary causes on the Lower California peninsula, and practically all mining continued as usual unless there was some other cause for interruption.

Operation of the Tezuitlan smeltery, in Puebla, Mexico, has been risky, and at the present time it is not known when operations can be resumed. The plant has been closed for nearly a year.

The Batopilas Mining Co. started work at its property in southwestern Chihuahua on Sept. 7. Both mills are running at about two-thirds capacity, and will be increased to the maximum as soon as possible.

Central America in 1914

The operating properties in Central America being mainly precious-metal mines, there was little interruption from the financial situation arising out of the European war. Producing mines were consequently operated about as usual, though developing properties and new enterprises were stopped or held in abeyance.

In Costa Rica the Aguacate Mines continued the successful development of its properties near San Mateo. In the horizon drained by the seventh-level adit, the orebody was proved for about 1500 ft. in length and 225 ft. vertically, and the outlook is even more promising than at the end of 1913. Besides the regular ore of the Black vein, the company encountered a bonanza section from which a yield of at least a million dollars is assured. The ore milled in November averaged $28 per ton, and in December a "bonanza" shipment was being prepared. A 10th-level adit to cut the orebody at a depth of 300 ft. below the present workings is being driven. Some of the outlying veins on the company's property were also prospected with favorable results. The Abangarez Goldfields operated steadily until about May, when highgrading and pilfering of precipitate became so frequent that trouble ensued with the men when measures were taken to stop this stealing. In June it became necessary in the absence of local authority to call soldiers to the camp to maintain order. The company then decided to curtail operations until laws were passed to prevent these illicit losses. Only development work was therefore done at the Tres Hermanos and San Rafael during the last half of the year. Stoping of the low-grade ore continued uninterruptedly at the Boston mine and was sent to the 20-stamp mill at that property. Full operations at all the properties will not be resumed until the remedial laws now before Congress are passed. La Union mine of the Panama & Costa Rica Mining Co. continued its successful career, crushing at the rate of 3000 tons per month. The ore was treated by amalgamation in the 30-stamp mill and by cyanidation in the new plant completed in 1913, the extraction averaging about 93%. Operations were resumed at the Bella Vista and Montezuma mines of the Montezuma Mines of Costa Rica. The Trinidad mine was under development with encouraging results, as was also the Sacra Familia in the Aguacate district; the Porvenir was bonded to New York men.

The principal operation in Honduras is that of the New York & Honduras Rosario Mining Co. at San Juancito. This company operated at increased capacity in 1914, treating about 108,000 tons of ore, yielding approximately 14,000 oz. of gold and 1,818,000 oz. of silver. The company gradually increased the duty of its 1850-lb. stamps until, at the end of 1914, the stamps were averaging a daily duty of 17 tons through three mesh. The company continued its geological survey of the district. Development work was done at the Sabana Grande mine on four veins; on two levels high-grade silver ore was found. The old Yuscaran district was the subject of some interest, work having been done at the Monserrate mine, preparatory to an examination. The Socorro Gold & Silver Mine, Ltd., at Valle de Angeles, started its mill about May 15 and operated throughout the year. The plant has a nominal capacity of about 30 tons per day, and in September was operating on ore carrying from 65 to 70 oz. of silver. Desultory placer operations were conducted in the department of Olancho and an American interest undertook a drilling campaign in a new district in this department.

In Salvador the two principal operations were the Butters Salvador Mines, Ltd., at San Sebastian and the Butters Divisadero Co. at Divisadero. The new shaft at San Sebastian was completed in August, and there was

no interruption of production from the caving ground in the lower part of the old shaft; production at the end of the year was at the rate of about $60,000 per month from 3000 tons of ore. At Divisadero the output was increased; new equipment added at the mine and mill, including five 1250-lb. stamps, and the pipe line and oil-fuel installation were completed.

Nicaragua experienced a setback in 1914 as the Central American Goldfields Syndicate, Ltd., controlled by Camp Bird interests, ceased work, owing to title difficulties; this company had optioned the Bonanza, Mars, Siempre Viva and other properties in the Pis Pis district. The Babilonia Gold Mines, Ltd., at La Libertad started its new cyanide plant, operating on the old tailings dump while the mine was being unwatered. The Javali & Escandalo Mining Co. in the same district began the construction of a cyanide plant. The Oroya-Leonesa, Ltd., was reconstructed and the property at Matagalpa taken over by Central American Mines, Ltd. Some work was done at La Luz mine in the Cuicuinita district.

Guatamala and Panama were comparatively inactive in 1914. In Trinidad the exploitation of the oil fields was continued, bringing the total number of wells drilled up to 147. According to the inspector's report for the fiscal year, 41 wells were drilled, averaging about 1000 ft. each; 18 were productive and the total output for the year was about 563,000 bbl. The principal producers were the Trinidad Lake Petroleum Co. and the United British Oilfields of Trinidad; the latter at the end of 1914 was producing at the rate of about 800 tons per week. Important prospecting was done by Trinidad Leaseholds, controlled by the Consolidated Gold Fields of South Africa.

Cuba attracted attention in 1914 through a new copper mine in the western end of the island in the Province of Pinar del Rio; the Matahambre mine began shipping in December, 1913, and by April had shipped over 8000 tons, averaging 18% copper and 1.5 oz. silver. This mine paid for itself in the first cargo shipped, and copper prospecting in Cuba was much stimulated. The Matahambre production for 1914 was nearly 6,000,000 lb.; about 300 men were employed and the mine developments continued favorable; the unoxidized zone at the lowest adit averaged about 15% copper. The El Cobre mine of the Cuba Copper Co. was unwatered in 1914; after many years the bottom of the mine, at 1100-ft., was capable of being prospected, and chalcopyrite-ore shipments averaging 8% Cu demonstrated the value of this work; beside the shipping ore, there were found bodies of low-grade ore that is amenable to flotation. Prospecting was carried on throughout 1914 by the Davison Chemical Co., of Baltimore, at Carlotta, north of Cienfuegos, where a large body of cupiferous pyrite was being drilled. All the iron mines of Cuba operated at much reduced capacity in 1914, the Mayari mines on the north coast at one-quarter capacity and the Daiquiri mines at about one-half capacity. El Cuero iron mine of the Ponupo Manganese Co. operated for four months. No manganese ore was shipped, although one small manganese property at the end of 1914 was preparing to make shipments.

South America in 1914

The northern states of South America, which produce more gold, were not so much affected by the war conditions as were the countries of the West Coast, where the mining industry was in a comatose condition in the latter half of the year, except at mines that were in the hands of strong companies.

Colombia

Prospecting was not so active in Colombia in 1914 as in 1913. Despite several interruptions, the Pato gold dredge continued in 1914 its remarkable yield, returning over half a million dollars from less than one million cubic yards, the yield in December averaging over $1 per cu.yd. At the associated San Francisco property, on the opposite side of the Nechi River, the drilling proved highly satisfactory, over 7,000,000 cu.yd. having been indicated with an average value of over 70c. per cu.yd.; a dredge is being constructed.

The Pochet dredge operated successfully near Pinéa, on the Nechi River, about two miles north of Zaragoza. The Antioquia-Guadalupe placer on the Porce River, near Barbosa, was tested by the Marquette-Magdelena company, a subsidiary of Breitung & Co., Ltd. McGuire Brothers, who operated La Clara placer successfully for several seasons, extended their operations during 1914, importing equipment for the operation of the Hormiguero and Miraflores placers, also on the Porce. On account of rich cleanups near the Porci River bed, McGuire Brothers are making preparations to divert the course of the river and wash the old river bed; new hydraulic elevators and a 30-in. inverted siphon were ordered for this purpose. A long season was experienced at La Clara and the cleanup was about $100,000. Some new equipment was installed by the Rio Grande & Porce Mining Co. for the purpose of washing its gravel near the Hormiguero. The Vallecitos Hydraulic Mining Co. began washing at Anori late in the year, with an increased water supply; the San Benigno placer adjoining was worked in a small way. The Viborita placer, near Amalfi, was idle in the latter half of the year. Activity among the placers of the upper Atrato region was largely suspended, pending the outcome of title litigation; nevertheless, the Anglo-Colombian Development Co. began shipping the machinery for the dredge it ordered from Lobnitz & Co. for its property near Novita. The Certigue Dredging Co. made preparations in the autumn to resume operations on the river of that name, sending its engineer, R. J. H. Bradley, to visit the property.

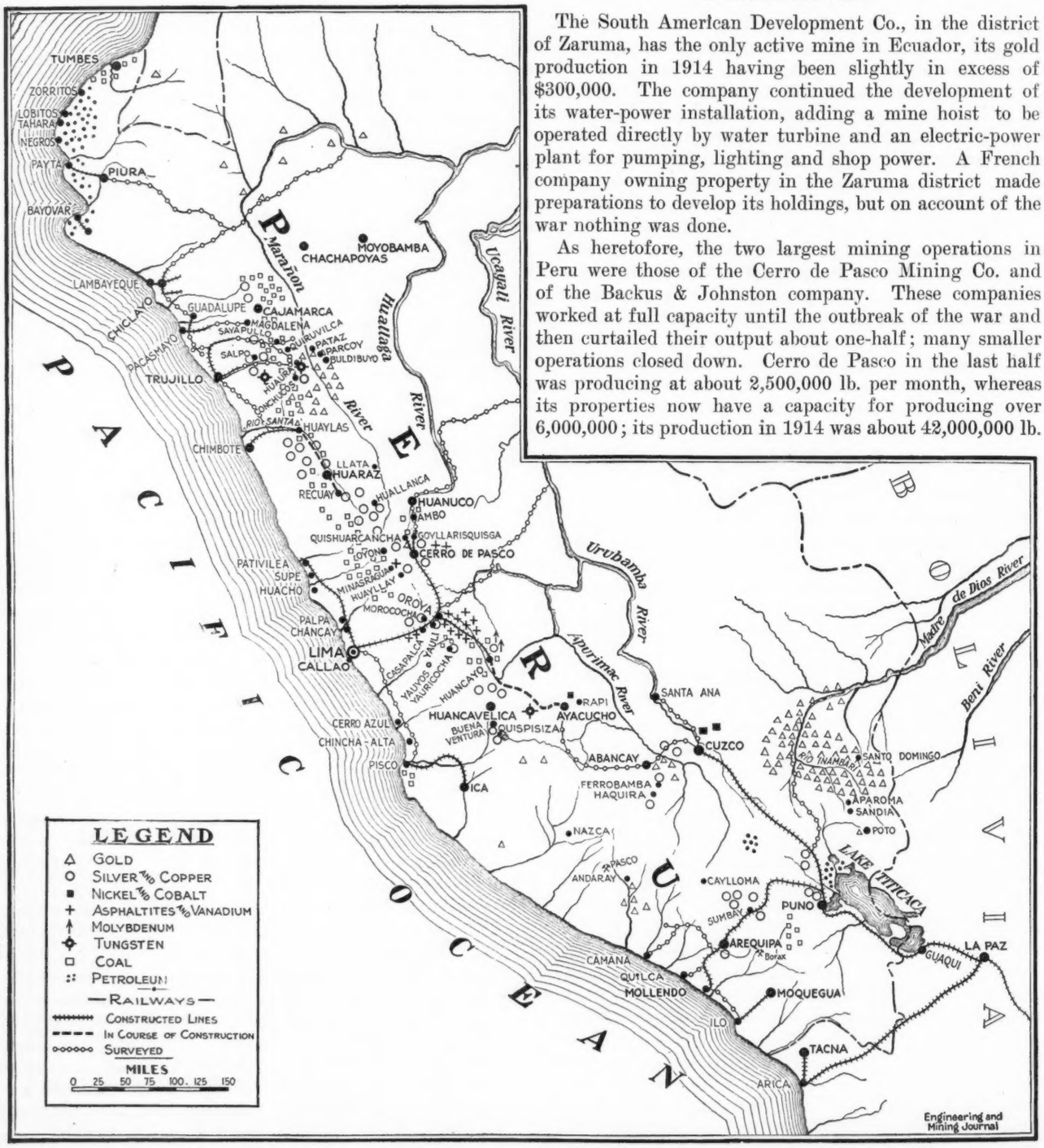
Most of the gold and silver obtained from lode mining in Colombia is mined in the Departments of Antioquia, Caldas, Tolima and Bolivar; the production in the Choco is insignificant. Antioquia, as usual, held first place. The Zancudo mine, in the district of Titiribi, maintained its usual production of about $30,000 per month; the value of the ore is about $15, two-thirds being silver and one-third gold. The Britannia, the only other silver mine in the department, shipped its product in the form of concentrates. The Frontino & Bolivia company operated throughout 1914, milling about 2000 tons per month for a monthly yield of about $70,000; the company endeavored

to increase its ore reserves and is reported to have opened good ore at depth in one of its mines. Among other active quartz mines in the department were the Otramina, Constancia, Andina and Trinidad; in addition, there are about 60 properties that make an intermittent production. In the department of Caldas, the Marmata and the Cascada were the principal producers. At Fresno, in the department of Tolima, the Frias silver mine, operated by the Tolima Mining Co., produced about 16,000 tons which, after hand picking and concentrating, yielded about 560,000 oz. of silver and lead to the value of about $22,000. In the Guamaco district, in the department of Bolivar, the Libertad mine of Messrs Small & Burdett operated and installed a hydro-electric plant with a view of increasing the milling capacity. The Concordia mine, under the management of K. C. Parrish, installed a mill. The Marquette-Magdalena Co. did development work on the Topacio lode mine, on Caceri Creek, in Antioquia, and at the Churima mine, on a river of the same name in the Choco territory. The value of mineral exports from Colombia in 1913 was reported by the *Pan-American Union Bulletin,* as $5,514,600, of which over $4,100,000 was gold and $583,995 was platinum. The gold production was about equally divided between placer and lode mines.

Ecuador and Peru

The South American Development Co., in the district of Zaruma, has the only active mine in Ecuador, its gold production in 1914 having been slightly in excess of $300,000. The company continued the development of its water-power installation, adding a mine hoist to be operated directly by water turbine and an electric-power plant for pumping, lighting and shop power. A French company owning property in the Zaruma district made preparations to develop its holdings, but on account of the war nothing was done.

As heretofore, the two largest mining operations in Peru were those of the Cerro de Pasco Mining Co. and of the Backus & Johnston company. These companies worked at full capacity until the outbreak of the war and then curtailed their output about one-half; many smaller operations closed down. Cerro de Pasco in the last half was producing at about 2,500,000 lb. per month, whereas its properties now have a capacity for producing over 6,000,000; its production in 1914 was about 42,000,000 lb.



Peru, Showing the Situation of the Chief Mineral Resources

The Backus & Johnston company in 1914 completed the campaign of improvements, but reduced its output. Both companies have completed their hydro-electric power plants, and their smelting works are now largely operated by electric power. The Fernandini, Lampa and other small reduction works were operated at about three-fifths capacity during the year. Ferrobamba was not operated.

Among the gold mines, the New Chuquitambo, in Cerro de Pasco, ran steadily, treating in October 1641 tons for a recovery of 10,150 grams. Andaray-Pasco, in the department of Arequipa, and Cotabambas, in Apurimac, operated throughout the year. The new mill at the Santa Domingo mine of the Inca Mining Co., in Puno, was completed, but the company did not operate all the year. Production from the gold placers was small; Aporoma washed about 68,000 cu.yd. during the early rainy season for a recovery of 7.8d. per cu.yd.; water shortage was again experienced, and about £11,000 was recommended to be spent on increased water supply. The Marañon River Placers, Inc., a subsidiary of the Peru Gold Placers, Inc., did drilling on its ground along the Marañon River; the company had a force engaged in completing a power ditch and in other work preparatory to the equipment of its property. There was some exploration in the North by the Peruvian Mining & Development Syndicate, Ltd., on the eastern slopes of the Andes, especially along the Chinchipi and Tabaconis rivers. An examination of the placers controlled by "Swiftwater Bill" Gates, in the department of Arequipa, was begun late in 1914 for an important American interest.

The old silver mines at Caylloma were operated, but it is understood that the production was less than in 1913. The tungsten mines in the vicinity of Huaura were worked in the early part of the year, but operations were suspended later on account of the market conditions. The borax mines in the southern part of the republic were also idle at the end of 1914. As heretofore, most of the coal used in Peru was mined by the Cerro de Pasco company at Quishuarcancha and Goyllarisquisga. The petroleum output was reduced toward the end of 1914, but the Standard Oil Co. increased its interests in the field on the northern coast of Peru; the International Petroleum Co., Ltd., was incorporated to accomplish the consolidation of the London & Pacific, the West Coast and the Lagunitos; the Standard interests also have a large holding in Negritos and in the Lobitos Co., the stockholders of which will be given an opportunity to join in the consolidation. Until late in the year, the Zorritos properties of Faustino G. Piaggio & Co. operated as usual; an engineer representing a Dutch petroleum interest examined these properties in 1914. Drilling was in progress on the Cardalitos land north of Payta.

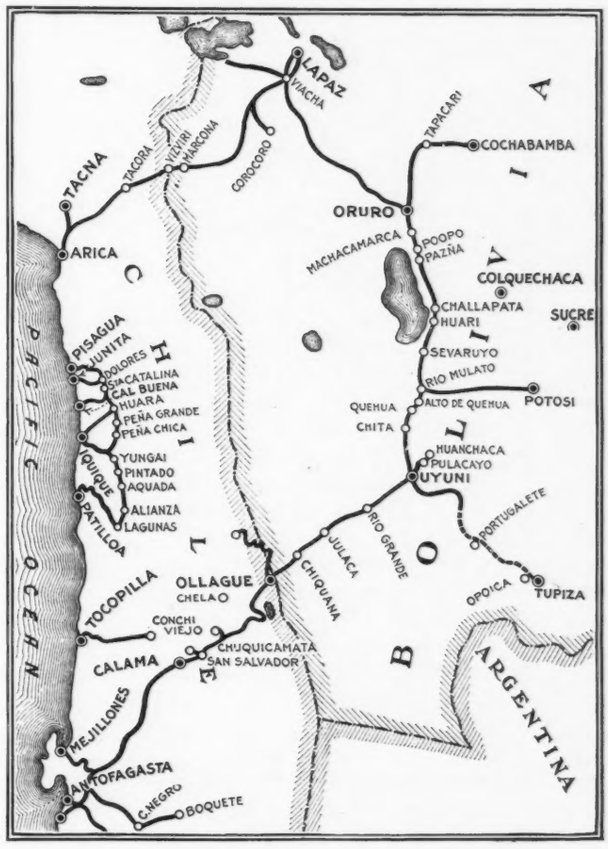
Bolivia

On account of the fall in price of the principal metals produced in Bolivia, 1914 was a poor year for most mining companies. Tin producers began restricting production when the price began declining in May and, after the war broke out, the large producers were also compelled to curtail; the tin situation in Bolivia will be dealt with at length in a subsequent issue. The copper producers, Corocoro United and Corocoro of Bolivia, also reduced their output, and silver production from Huanchaca, Potosi and Oruro was likewise restricted. The financial crisis released much labor and gave the gold mines a chance to go forward with their developments, notably the Olla de Oro, at Umabamba, and the Incaoro, at Pallaya, both of which increased their milling capacities.

Evidences of petroleum were discovered at Espejos Springs, near Santa Cruz, on the Eastern slope. The exports of Bolivian mineral products (concentrates or high-grade ore in most cases) through the ports of Antofagasta and Mejillones, for the first eight months of 1914, were reported by U. S. Consul O'Rear as follows: Tin, 26,021 metric tons; copper, 202; bismuth, 163.52; wolfram, 145.78; antimony, 120.77 metric tons. In 1913, 44,594 tons of tin *barrilla* were shipped.

Chile

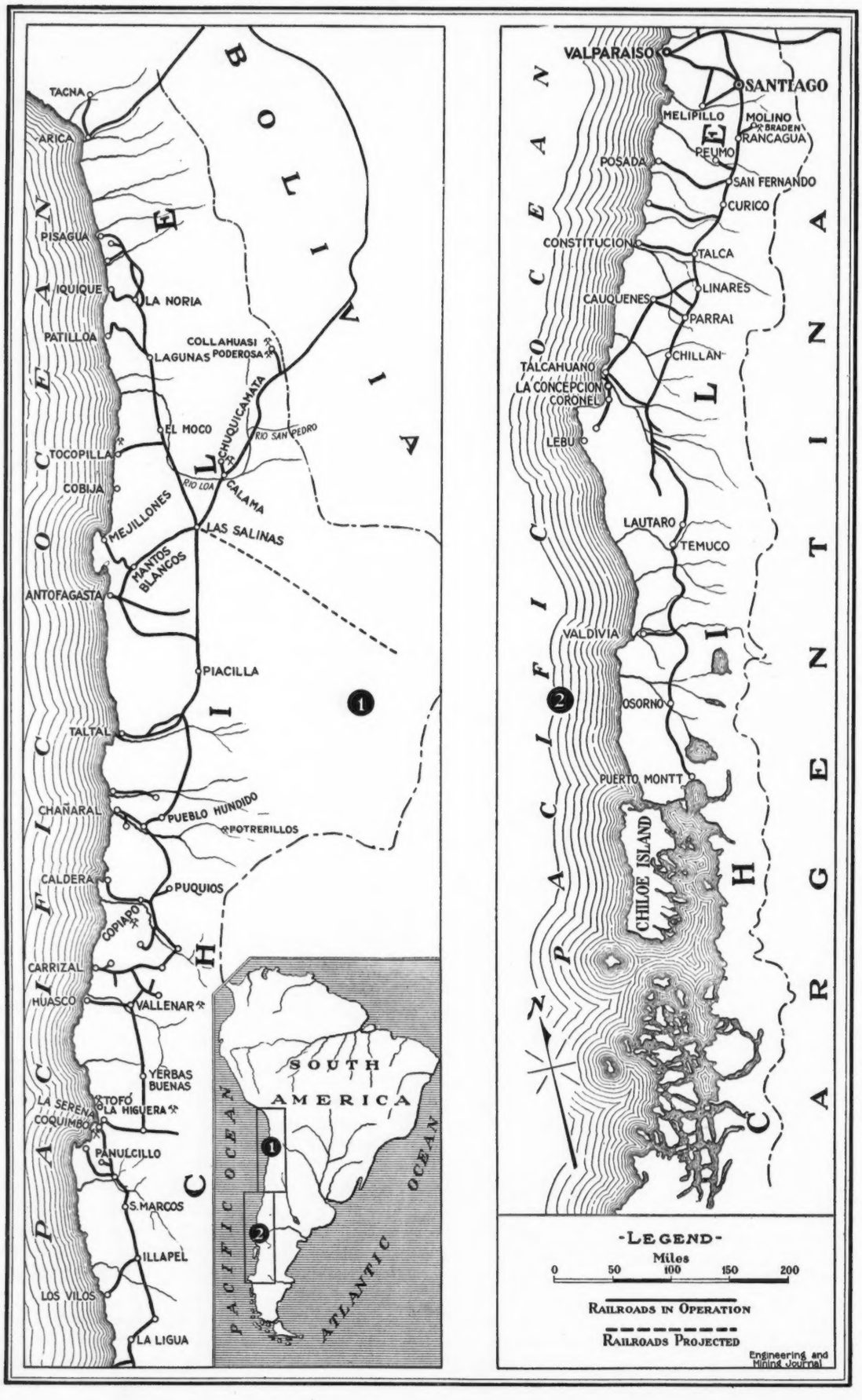
Chile, toward the close of the first six months of 1914, was reaching a prosperous condition, due to the increased



Bolivia and Northern Chile

nitrate and copper productions. The European situation changed matters to such an extent that the reduction of the country's income was of serious moment. The rate of nitrate production since Aug. 1, 1914, is approximately 50% of the first seven months' average. The province of Tarapaca suffered most severely; over one million tons of refined product is stated to be lying in the various nitrate ports. The only American nitrate company in the industry, the Dupont Nitrate Co., suffered no setbacks; its present production is at the rate of 600,000 quintals (46 kg.) per annum.

At the three leading metal mines of Chile, the Chuquicamata and Braden copper mines and the Tofó iron mines, work was not abated on account of the war or the financial stress arising therefrom. Most of the smaller



THE MINING REGIONS OF CHILE—BASED ON A MAP FURNISHED BY THE PAN-AMERICAN UNION

copper companies curtailed operations after August and some stopped completely. Exceptions to these were the Catemou, Naltagua, Chañaral and the Copiapo companies and the Central Chile Copper Co., at Panulcillo, where important improvements were made, outlying properties optioned and a new power plant erected; in the north, at Collahuasi, the Poderosa and the Société Francaise des Mines de Cuivre mined their high-grade ores; the French company erected a small experimental plant to concentrate the low-grade siliceous ore now on the dumps. The Braden Exploration Co. explored its Potrerillos group of copper claims, about 90 miles back from Chañaral, and also made preliminary examinations of two properties in the vicinity of Santiago.

The enterprise of the Chile Copper Co., at Chuquicamata, was prosecuted vigorously in 1914, between 2000 and 3000 Chileans being employed on the work besides 200 or 300 Americans and Europeans. The prostration of the nitrate industry, owing to the European war, threw many laborers out of employment and furnished the Chuquicamata mines with an abundant supply of labor, enabling construction work to go forward with such expedition that the operating officials at the end of 1914 estimated that the plant would be ready for operation about Mar. 31, 1915. The equipment for the power station at the port of Tocopilla and for the electric substation at the mill was made in Germany, and when the war broke out, a large part of this equipment was on board more than a dozen English and German steamships afloat in the Atlantic and Pacific Oceans, and part of it was still in Europe; fortunately, however, neutral ships were obtained and all of this material was gotten out of these steamships and out of Germany, and most of it is delivered. All of the equipment for the railway, the transmission line and the mine and some of the mill equipment was made in the United States and the installation of same was nearly completed. Officials of the company state that Chuquicamata is now the largest known deposit of copper in the world, and expect before long that it will be the largest and cheapest producer of copper in the world. The development of the mine by drills was continued in 1914 and the tonnage developed now exceeds 300,000,000; the exact amount reported by the company's engineers on Dec. 6, 1914, was 297,000,000 tons, averaging over 2% copper.

The Braden Copper Co. continued its operations, increasing its developed tonnage and improving its metallurgical treatment. At the end of December, 1913, Consulting Engineer Pope Yeatman reported 78,000,000 tons of 2.5% copper ore, classified as developed, probable and possible; the work of 1914 materially increased this tonnage. The company produced at the rate of about 2,400,000 lb. of copper per month. One of the features of the metallurgical improvement was the installation of the preliminary nodulizing kiln, of which three were shipped; the first kiln did good work and led the company to anticipate satisfactory results in preparing the flotation concentrates for treatment in the blast furnaces.

Exploration work by means of tunnels materially increased the ore reserve at Tofó iron mines, which are now being developed and operated by the Bethlehem-Chile Iron Mines Co. Tunnels in the ore at about 500 ft. below the top of South Hill disclosed the interesting fact that there had been no increase in the sulphur content of the ore at this depth. In 1914, about 63,000 tons of ore were shipped by means of the aërial tramway to Cruz Grande and thence by steamer to the United States and Europe, the latter ore being consigned to Europe to fulfill some contracts entered into by the precedent French company. An important feature of the 1914 work was the development of the water rights of the San Juan group of copper mines at La Higuera, from which a supply of 300,000 gal. per day is ultimately expected. Shipments in 1915 are expected to aggregate 200,000 tons. Tofó developments will be more fully presented in a subsequent issue. Some other important iron properties, especially the Pleito and Zapallo mines, were optioned in 1914, but owing to the extraordinary conditions prevailing, these negotiations came to naught.

East Coast Activities

In the Argentine Republic, the mining industry was not especially active in 1914. The established mines, such as tungsten, borate, tin, etc., operated about as usual, although the principal copper mine, the Famatina, is understood to have been idle. There was not much activity in oil drilling following the recommendation for nationalization of the Comodoro Rivadavia fields by Engineer Platz, who submitted an exhaustive report.

In Uruguay, the geological survey was continued under Dr. M. A. Lamme. The only active mining property was that of the Uruguay Consolidated Gold Mines, at Corrales, in the department of Rivera; this company was reconstructed, having gone into liquidation late in 1913.

The most active mining properties in Brazil in 1914 were, as usual, its two important gold mines, the St. John del Rey and the Ouro Preto. These gold properties were benefited by the surplus of labor released from construction work after the war, and the fall in exchange more than counterbalanced any increase in shipping expenses. The St. John del Rey crushed at the rate of about 200,000 tons for the year, the first half having averaged 95,000 tons, yielding 47s. 5½d. per ton. The most interesting work in the mine was the sinking of the "G" shaft to horizon 20, i.e., 600 ft. below the lowest working level. The Ouro Preto company, owing to having encountered a poor zone in 1913, had to be reconstructed in 1914, and plans were made to mill on a larger scale, gradually increasing to 10,000 tons per month. The August crushing was 6900 tons, yielding 2591 oz. The cyaniding costs at both of these mines are unusually low. Some investigations were made in the Turyassu gold region and an American exploring party was engaged along the Rio Tocantins.

In the Guianas mining was active and the gold production probably exceeded that of 1913. Late in that year the dredging fleet received an addition in the Mataroni dredge on the Rivière Approague; in Dutch Guiana, the Guiana-Callao Gold Mining Co. increased its mining rights to cover an area of 5000 acres, and made plans for increasing its milling equipment; in British Guiana the gold and diamond shipments in the first half of the year exceeded those of 1913, but the diamond production declined after August.

Venezuela

The South American Copper Syndicate, operating the Aroa group of mines, started its new smelting plant in the spring of 1914, but the preliminary difficulties incident to starting the new works, carried the company op-

erations into the period affected by the war and the year was not a prosperous one, as production was then reduced to a minimum. Besides the old Aroa mine, the company was preparing to stope ore in the Aroa North and the Titiara mines. In the latter half of the year, mining was restricted to a production just sufficient to pay for the operations. The Cumaragua company of Caracas continued the exploration of its group of mines in the Aroa district, power drills having been installed; the old copper mines at Buria, near Nirgua, were also under development. El Amparo mine, of the Rio del Oro Co., Ltd., 12 miles east of Guasipata, in the State of Yuruary, increased its production in the latter part of 1914. The October cleanup was 863 oz. and in November, 628 oz. Good ore was encountered on the No. 2 level in November. Drilling for petroleum was continued by several companies. A new mining code was promulgated in August and, by an executive decree of Sept. 19, deposits of coal, petroleum and asphalt were made inalienable.

Borax and Borates

Borax production in California during 1914 was less affected by the war conditions than any of the other minerals. The mining of borate ores went steadily forward with little check, even in the latter months of the year, both at the mines of the Sterling Borax Co., at Lang, Calif., and at the mines in Death Valley of the Pacific Coast Borax Co., the two important American producers. In fact, there was considerable construction work done at the Death Valley mines. A new branch of the Tonopah & Tidewater Ry., which is controlled by the Borax Co., about 20 miles long through a rough country, was built to its Biddy McCarthy and Monte Blanco deposits. This represented approximately an expenditure of $400,000 and opens up some of the finest deposits in the Death Valley section, which hitherto had not been accessible on account of poor transportration. The Pacific Coast Borax Co. also built during the year a large calcining plant at Death Valley Junction, on the T. & T. road, to roast the low-grade ores before shipment to its refineries.

No new borax mines were developed during the year and the refining of borate ores into borax and boracic acid is confined to the plants at Bayonne, N. J., Brooklyn, N. Y., New Brighton, Penn., and Chicago, Ill., with the exception of a small amount of refining which is done at San Francisco for the Pacific Coast and Japanese trade.

The war in Europe has temporarily interfered with the European business, which is controlled almost entirely by Borax Consolidated, at London. This company, in addition to its English and French refineries, has refineries in Austria and supplies all the German refineries with their borate ore from Chile.

With Turkey also precipitated into the conflict, this temporarily ties up the mines on the Sea of Marmora, controlled by the English company, which have been an important source of supply for the French and Austrian refiners for many years, as they were worked before the South American deposits had been developed. The dislocation of foreign business conditions has resulted in considerable export of both refined borax and boracic acid from this country, particularly into Canada, which formerly was supplied from England. Without going into figures it is safe to say that the stimulus of the export business has more than offset the falling off of business in this country and production of borate ores for 1914 was fully up to the 1913 output.

The A. S. & R. Co. in Mexico in 1914

By S. W. Eccles*

The operation of the mines in Mexico belonging to the American Smelting & Refining Co. has been considerably interfered with in 1914. At the time of the landing of the American troops at Vera Cruz, all operations were suspended temporarily, but as soon as it was apparent that no crisis was to be precipitated, operations were resumed at several of the properties. Interruptions to traffic, particularly on the branch lines of the Mexican Ry., made it difficult to obtain the necessary supplies and to move the ore produced to the smelter. During the year none of the plants suffered any damage because of the Mexican revolutionary troubles. All Mexican factions have respected the property rights and the rights of all foreign employees. At the different properties most of the foreign employees have been retained, as well as the nucleus of the Mexican laboring force.

At Santa Eulalia the mines are producing almost a normal tonnage, making daily shipments to the Chihuahua smeltery. At Santa Barbara preparations are being completed to resume mining and milling.

From Sierra Mojada shipments are being made to the smeltery at Chihuahua. The Velardeña mines are working and shipping continuously to the smeltery at Asarco. Work has recently been resumed at the mines at Angangueo and Tepezala. From other properties at Charcas, Bonanza and Cuatro Cienegas, some shipments are being made.

It is believed that operating conditions will soon become normal in Mexico, and if so the properties should resume operations with a very large output of profitable ore in the near future.

Opening of the Alaska Coal Lands

On New Year's Eve Secretary Lane, according to an announcement by the Department of the Interior, signed the regulations by which the coal lands in Alaska, outside of the Bering River and Matanuska fields, are opened in 10-acre tracts to the people of Alaska. The regulations are simple, calling for nothing excepting the staking of the ground and application to the local receiver for the use of it, which is to be granted for two years. The Government makes no charge.

Western Australia 1913 Mineral Production

The mineral output of Western Australia in 1913 consisted of the following items, arranged in order of descending value: Gold, 1,314,043 oz. (£5,581,701); coal, 313,818 long tons; copper ingot, matte and ore, 4321; tin ingot and ore, 484; lead ore, 3169 long tons; silver, 188,020 fine oz. (£23,420); pyrites, 10,216 long tons; all else, approximately £215.

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Mining in the Transvaal in 1914

By H. F. Marriott*

At the end of 1913 the outlook for the mines of the Rand for the succeeding year was better than ever before in the annals of the industry. The hard work put into details of organization, and the improvements in methods of mining and lay-out of development during the previous few years, had slowly but surely rendered the mines more capable of regular output which could be fairly closely estimated for several years ahead. But 1914 was scarcely begun when a change in the aspect of affairs took place. In January a strike of railway employees occurred and threatened to spread to other industries and involve the whole country in a revolutionary agitation. Profiting by their experience of the previous year the government immediately handled the situation with such energy and firmness that the revolutionary movement was quickly and effectively suppressed. The majority of the mining population proved its desire to be law-abiding by remaining at work once it was assured of adequate protection. The defection of a certain number of employees was not sufficient to do more than cause a short diminution of output, and the value of firm government was shown by the industrial peace which obtained during the remainder of the year.

TABLE I. TRANSVAAL GOLD PRODUCTION

Witwatersrand District

Year	Tons Milled	Value	Value per Ton Milled, Shillings	Outside Mines, Value	Total Value for Transvaal
1884-89 ...	1,000,000	£2,440,000	48.8	£238,231	£2,678,231
1890.....	730,000	1,735,491	47.4	134,154	1,869,645
1891.....	1,154,144	2,556,328	44.2	367,977	2,924,305
1892.....	1,979,354	4,297,610	43.3	243,461	4,541,071
1893.....	2,203,704	5,187,206	47.0	293,292	5,480,498
1894.....	2,830,885	6,963,100	49.2	704,052	7,667,152
1895.....	3,456,575	7,840,770	45.2	728,776	8,569,555
1896.....	4,011,697	7,864,341	39.2	739,480	8,603,821
1897.....	5,325,355	10,583,616	39.7	1,070,109	11,653,725
1898.....	7,331,446	15,141,376	41.3	1,099,254	16,240,630
1899.....	6,872,750	15,067,473	48.8	661,220	15,728,693
1900.....	459,018	1,510,131	65.8	.....	1,510,131
1901.....	412,006	1,014,687	49.2	81,364	1,096,151
1902.....	3,416,813	7,179,074	42.0	74,591	7,253,665
1903.....	6,105,016	12,146,307	39.8	442,941	12,589,248
1904.....	8,058,295	15,539,219	38.5	515,590	16,054,809
1905.....	11,160,422	19,991,658	35.8	810,416	20,802,074
1906.....	13,571,554	23,615,400	34.8	964,587	24,579,987
1907.....	15,523,229	26,421,837	34.0	981,901	27,403,738
1908.....	18,196,589	28,810,393	31.6	1,147,217	29,957,610
1909.....	20,543,759	29,900,359	29.1	1,025,429	30,925,788
1910.....	21,432,541	30,703,912	28.5	1,297,823	32,001,735
1911.....	23,888,258	33,543,479	28.1	1,498,006	35,041,485
1912.....	25,486,361	37,182,796	29.2	1,574,765	38,757,560
1913.....	25,628,432	35,812,605	27.8	1,545,435	37,358,040
1914 (est.)..	25,873,176	34,151,183	26.4	1,444,731	35,595,914

From Table I it will be seen that the estimates for the year show a slight increase in the tonnage milled but a decrease in the output of gold from that of the previous year. The drop in yield per ton milled was doubtless in part attributable to the fact that during the disturbed period development had to give place to the effort to sustain the tonnage output, and therefore lower-grade stopes were called on to supply more than their previous quota to the mills.

No company suspended operations during the year. The Cinderella Consolidated and the Jupiter, which ceased milling in 1913, did not recommence production. The new producers were in the Eastern Rand district, and will, therefore, be referred to in detail in the section dealing with that part of the Witwatersrand.

Only one company amalgamation took place during the year. It was agreed to raise the capital of the New Kleinfontein Co., Ltd., by 181,540 new £1 shares, and that that company should take over the entire concern of the Benoni Consolidated Gold Mines, Ltd., and the gold section of the Apex Mines, Ltd. Proposals for the absorption of the Robinson Gold Mining Co., Ltd., by the Crown Mines, Ltd., were brought forward but were not carried through.

In contradistinction to this period of inactivity in rearrangement of working units, however, a policy of control of much wider significance was brought to light and widely discussed. The scheme brought forward involved nothing less than the amalgamation or unification of the whole of the Rand. The matter was the subject of comment in both government and business circles, and came before the Dominions Royal Commission during its visit to the country. But there the matter has for the time being ended.

Several undertakings in the Eastern Rand progressed satisfactorily. The Van Ryn Deep declared its second dividend in June, the amount being 2s. 6d. per share as against 1s. 6d. per share declared at the end of 1913. At the end of October the Government Gold Mining Areas commenced production. Fifty stamps were first dropped, the remaining 50 being brought gradually into operation. The battery of the Modderfontein Deep Levels will be at work in 1915. The seven-compartment shaft of the Daggafontein Gold Mining Co. intersected the reef during the year at a depth of 3580 ft. and was stopped when it reached 3618 ft. in depth. The assay results obtained from the shaft were higher than those afforded by the bore-holes. At the Springs Mines the proportion of profitable development for the second quarter of the year was given as 51%, and the profitable development at the Brakpan Mines was declared as increased to 48% during the first half of the year. Development at the Geduld Proprietary Mines gave satisfactory results. During the quarter ended Mar. 31, samples taken over 1245 ft. gave 35.7s. over 35.2 in., and for the quarter ended June 30 the results over 1375 ft. of development were 30.2s. over 38.1 inches.

In technical matters, while no great departure was made from the usual methods, improvements and progress of a minor character were recorded.

Of the various circular shafts in course of equipment that of the Crown Mines attained the greatest rate of progress. At the end of September the shaft was stopped, for the time being, at a total depth of 2505 ft., or 69 ft. below the 16th-level station. The average rate of sinking was about 156 ft. per month, and the average cost, exclusive of surface equipment, £16 2s. 11d. a foot. Mechanical shoveling machines were introduced on the Rand during the year. At the Crown Mines, in a drift 12x10 ft., 40 carloads of two tons each were removed in 3½ hours.

The Whiting hoists at the Turf Mines shaft of the Village Deep, Ltd., gave trouble at the greater depths to which they were called on to work owing to the internal strain set up in the engines by the rope coils on the reels. Their replacement by drum engines was considered, but in the meantime it was ascertained that by substituting electric power for steam and by using only one coil round the reels instead of three, the efficiency of the engines was

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largely increased, and they were thereafter able to cope satisfactorily with the work required to be done.

The value of the method of supporting the ground above the worked-out areas by sandfilling the old stopes was again demonstrated in no uncertain fashion. A movement of ground occurred in the Village Main Reef which temporarily disabled the main hoisting shaft and there is no doubt that, had the mine not been protected to a considerable extent by sandfilled areas, the safety of the present workings would have been seriously jeopardized.

The further equipment of the Modderfontein B. Gold Mines included a battery of 16 Nissen stamps. Previously, four Nissen stamps had been at work at the City Deep and this new installation was the first material outcome of the results thus obtained on the Witwatersrand.

A feature of interest in the proposed new equipment for the New Modderfontein was the reversion to single-treatment tanks in the cyanide plant design, separate collecting tanks being done away with. This was considered advisable owing to the good classification of sands and slimes now capable of attainment by means of cone classifiers.

A method of overcoming the dust evil occasioned by the great tailings dumps was successfully applied in several instances during the year. Common salt is added to the slimes solution and the mixture sprayed over the surface of the dumps. The hygroscopic action of the salt keeps the coating sufficiently damp to prevent the sand from drifting.

TABLE II. STAMPS AND TUBE MILLS

	Stamps at Work	Tube Mills at Work	Duty per Stamp per Day
1909 December	9250	148	6.8
1910 December	9150	184	7.2
1911 December	9565	244	7.9
1912 December	9440	277	8.4
1913 December	9170	278	8.7
1914 September	9296	283	8.9

An important water-supply scheme was sanctioned by the Union Parliament during the year. The Rand Water Board was empowered to borrow up to £1,250,000 for the purpose of constructing an impounding reservoir and barrage across the Vaal River, and to recover contributions from the beneficiaries, the liability of the mines being 46¼% of the cost. The supply of water for the Rand from this source is estimated at 10 to 20 million gallons daily.

TABLE III. LABOR EMPLOYED IN TRANSVAAL GOLD MINES

		Whites	Natives	Native Death Rate per 1000
1910		25,376	191,784	35.72
1911		25,108	194,286	31.01
1912		24,334	206,121	28.83
1913		22,797	162,181	26.61
1914	Jan.	20,715	166,817	
	Mar.	21,768	177,112	
	May	22,086	181,416	
	July	22,324	182,469	
	Sept.	22,088	183,911	12 mos. end. Sept. 19.32

Interest during the year centered largely in the reports of several commissions. The first to appear was that of the Sunday Observance Commission, published in February. It recommended, amongst other things, that milling on Sunday should cease within a period of three years.

The eagerly awaited report of the Economic Commission appeared in March. Closely affecting mining were the recommendations to widen the field of employment for workers other than whites, to substitute the system of day's-pay-cum-bonus in place of the contract system, the working of three shifts or the introduction of longer intervals when working two shifts, and the recognition of the principle of one day's rest in seven.

The Dominions Royal Commission conducted the South African part of its inquiry during the year under review. Its third interim report, dealing with the trade of that country, was issued in London in July. Special interest attaches to it on account of the information it contains about the undeveloped areas and the so called "life" of the Rand. With regard to the mining industry, it made recommendations respecting skilled white labor, the recruiting and scope of native labor, and the relation of the Government to the industry.

The report of the Select Committee on the Miners' Phthisis Act, issued in June, recommended a large increase in the compensation to be paid to Class A sufferers, the provision of a fund for helping the widows of victims, and the widening of the sphere of usefulness of the Phthisis Board.

The report of Surgeon-General Gorgas, made on behalf of the mines, concerning sanitary conditions on the Witwatersrand, appeared at the end of March. It recommended an increase of floor space to about 50 sq.ft. per individual by means of the village-hut system, with the introduction of families, a central hospital for sick natives, and the establishment of a central sanitary bureau.

The abolition of the "color bar," i.e., the limitations imposed upon the usefulness of the colored worker, was widely advocated, but no legislation to that end has yet been passed.

In August, on the outbreak of the present war, the Witwatersrand gold-mining industry was faced with the problem of realization on the gold produced and the obtaining of supplies. With regard to the first, arrangements were concluded whereby a continuance of delivery of the bullion to the Bank of England is assured. With regard to the second, it was agreed between the majority of the groups to pool supplies other than the stocks actually on the mines on Aug. 4. The South African Mining Groups Buying Committee was formed to arrange for the continuance of supplies of the chief imports required for use by the mining industry, and succeeded satisfactorily in so doing. It may be of interest to state that the value of the stores consumed by the mines of the Witwatersrand in 1913 amounted to £10,128,800.

Diamonds and Base Metals

The output of diamonds was stopped on account of the war, the De Beers and Premier companies closing down their mines on Aug. 7.

TABLE IV. DIAMOND OUTPUT

	Carats	Gross Receipts Total	Gross Receipts per Carat
1910	2,090,068	£1,317,715	12.6s.
1911	1,843,341	1,628,876	17.7
1912	2,131,406	2,386,979	22.4
1913	2,156,897	2,726,663	25.3
1914 (Jan.-June)	895,570	860,126	19.2

The continued fall in the selling price of tin during the year brought about a restriction of operations and a diminution of output from several of the Transvaal tin fields. The shipping ore produced during the eight months ending Aug. 31, 1914, however, was 2715 tons as against 2247 tons for the corresponding period in 1913.

There was a large expansion in the output of copper, 9593 tons of shipping ore being produced during the first eight months of the year. The production for the whole of the previous year was only 5755 tons. The Messina Copper Co. was still practically the only producer of the metal in the Transvaal, and the development during the year was stated to continue to open up large quantities of high-grade ore.